Finance

Course:
Financial Markets–
FINC–313

Instructor:
Dr. Robert Schweitzer

University of Delaware
Finance

McGraw-Hill/Irwin
A Division of The McGraw-Hill Companies

Primis Online

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Contents

Chapter 1

1 Introduction

OUTLINE

Chapter NAVIGATOR

1. What is the difference between primary and secondary markets?
2. What is the difference between money and capital markets?
3. What are foreign exchange markets?
4. What are derivative security markets?
5. What are the different types of financial institutions?
6. What services do financial institutions perform?
7. What risks do financial institutions face?
8. Why are financial institutions regulated?
9. Why are financial markets increasingly becoming global?

WHY STUDY FINANCIAL MARKETS AND INSTITUTIONS? CHAPTER OVERVIEW

In the 1990s, financial markets in the United States boomed. The Dow Jones Industrial Index—a widely quoted index of the values of 30 large corporations (see Chapter 9)—rose from a level of 2,800 in January 1990 to more than 11,000 by the end of the decade; this compares to a move from 100 at its inception in 1906 to 2,800 thirty-four years later. In the early 2000s, as a result of an economic downturn in the United States and elsewhere, this index fell back below 10,000. Further, several stocks traded in the NASDAQ stock market—a second major exchange—lost all gains they made in the late 1990s. While security values in U.S. financial markets rose dramatically in the 1990s, markets in Southeast Asia, South America, and Russia were much more volatile. The Thai baht, for example, fell nearly 50 percent in value relative to the U.S. dollar on July 2, 1997. More recently, in 2002, Argentina's economic and financial system collapsed and its currency fell more than 30 percent in value relative to the U.S. dollar as the government relaxed the peso's one-to-one parity peg to the dollar.

TABLE 1–1 Citigroup Product Lines

Citigroup focuses on nine key product lines. These nine key product lines comprise the entirety of Citigroup.
Credit Cards—World's largest provider of credit cards.
Second quarter '04 net income of $1.012 billion.
Consumer Finance—World's consumer finance leader.
Second quarter '04 net income of $594 million.
Retail Banking—Citibank: highest-rated, leading global brand.
Second quarter '04 net income of $1.156 billion.
Capital Markets & Banking—Number 1 underwriter of combined debt and equity and equity-related transactions.
Second quarter '04 net income of $1.502 billion.
Global Transaction Services*—Leading provider of transaction products; $7.0 trillion in assets under custody.
Second quarter '04 net income of $261 million.
Life Insurance & Annuities—One of the fastest growing life insurers in the United States with expanding international presence.
Second quarter '04 net income of $230 million.
Private Bank—Offers widest range of services to more than 25,000 of the world's most successful and influential families.
Second quarter '04 net income of $152 million.
Asset Management—A leader with $490.5 billion in assets under management.
Second quarter '04 net income of $69 million.
Private Client Services—A leader in managed accounts with $1.087 trillion in total client assets.
Second quarter '04 net income of $209 million.

*Transaction products include the custody and safekeeping of financial investments such as stocks and bonds.
Source: Citigroup Web site, August 2004. **www.citigroup.com**

Meanwhile, the financial institutions industry has gone through a full historical cycle. Originally the banking industry operated as a full-service industry, performing directly or indirectly all financial services (commercial banking, investment banking, stock investing, insurance provision, etc.). In the early 1930s, the economic and industrial collapse resulted in the separation of some of these activities. In the 1970s and 1980s new, relatively unregulated financial services industries sprang up (e.g., mutual funds, brokerage funds) that separated the financial service functions even further. Now, in the early years of the new millennium, regulatory changes, technology, and financial innovation are interacting such that a full set of financial services may again be offered by a single financial institution (FI) such as Citigroup. Table 1–1 lists information on the nine product lines offered by Citigroup. Not only are the boundaries between traditional industry sectors weakening, but competition is becoming global in nature, as German, French, and other international FIs enter into U.S. financial service markets and vice versa.

As economic and competitive environments change, attention to profit and, more than ever, risk becomes increasingly important. This book provides a detailed overview and analysis of the financial system in which financial managers and individual investors operate. Making investment and financing decisions requires managers and individuals to understand the flow of funds throughout the economy as well as the operation and structure of domestic and international financial markets. In particular, the book offers a unique analysis of the risks faced by investors and savers, as well as strategies that can be adopted for controlling and managing these risks. Newer areas of operations such as asset securitization, derivative securities, and internationalization of financial services also receive special emphasis.

This introductory chapter provides an overview of the structure and operations of various financial markets and financial institutions. Financial markets are differentiated by the characteristics (such as maturity) of the financial instruments, or securities that are exchanged. Moreover, each financial market, in turn, depends in part or in whole on financial institutions. Indeed, FIs play a special role in the functioning of financial markets. In particular, FIs often provide the least costly and most efficient way to channel funds to and from financial markets.

OVERVIEW OF FINANCIAL MARKETS

financial markets
The arenas through which funds flow.

Financial markets are structures through which funds flow. Financial markets can be distinguished along two major dimensions: (1) primary versus secondary markets and (2) money versus capital markets. The next sections discuss each of these dimensions.

Primary Markets versus Secondary Markets

Primary Markets. **Primary markets** are markets in which users of funds (e.g., corporations) raise funds through new issues of financial instruments, such as stocks and bonds. The fund users have new projects or expanded production needs, but do not have sufficient internally generated funds (such as retained earnings) to support these needs. Thus, the fund users issue securities in the external primary markets to raise additional funds. New issues of financial instruments are sold to the initial suppliers of funds (e.g., households) in exchange for funds (money) that the issuer or user of funds needs.[1] Most primary market transactions in the United States are arranged through financial institutions called investment banks—for example, Morgan Stanley or Lehman Brothers—who serve as intermediaries between the issuing corporations (fund users) and investors (fund suppliers). For these public offerings, the investment bank provides the securities issuer (the funds user) with advice on the securities issue (such as the offer price and number of securities to issue) and attracts the initial public purchasers of the securities for the funds user. By issuing primary market securities with the help of an investment bank, the funds user saves the risk and cost of creating a market for its securities on its own (see discussion below). Figure 1–1 illustrates a time line for the primary market exchange of funds for a new issue of corporate bonds or equity. We discuss this process in detail in Chapters 6 and 9.

primary markets
Markets in which corporations raise funds through new issues of securities.

Rather than a public offering (i.e., an offer of sale to the investment public at large), a primary market sale can take the form of a private placement. With a private placement, the securities issuer (user of funds) seeks to find an institutional buyer—such as a pension fund—or group of buyers (suppliers of funds) to purchase the whole issue. Privately placed securities have traditionally been among the most illiquid securities, with only the very largest financial institutions or institutional investors being able or willing to buy and hold them. We discuss the benefits and costs of privately placed primary market sales in detail in Chapter 6.

Primary market financial instruments include issues of equity by firms initially going public (e.g., allowing their equity—shares—to be publicly traded on stock markets for the first time). These first-time issues are usually referred to as **initial public offerings (IPOs).** For example, on April 29, 2004, Google announced a $2.7 billion IPO of its common stock. The company's stock was underwritten by several investment banks, including Morgan Stanley and Credit Suisse First Boston.

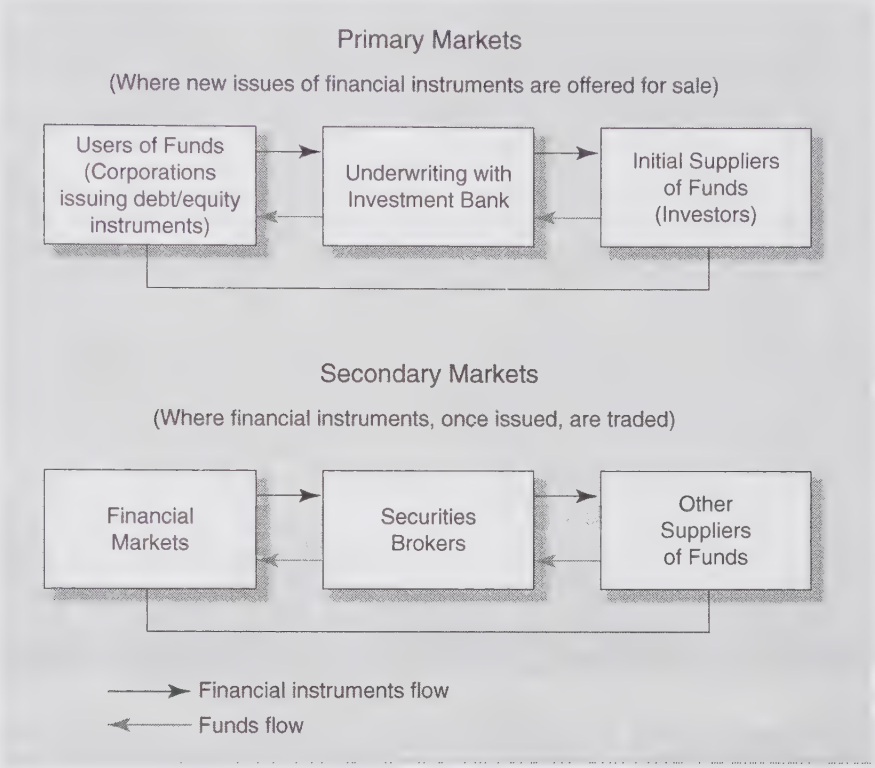
initial public offerings (IPOs)
The first public issue of financial instruments by a firm.

Primary market securities also include the issue of additional equity or debt instruments of an already publicly traded firm. For example, in May 2004 Allied Healthcare International announced the sale of an additional 14.5 million shares of common stock (at $4.90 per share) underwritten by investment banks such as SG Cowen & Co. and Friedman Billings Ramsey.

In recent years public confidence in the integrity of the IPO process has eroded significantly. Investigations have revealed that certain underwriters of IPOs have engaged in misconduct contrary to the best interests of investors and the markets. Among the most

1. We discuss the users and suppliers of funds in more detail in Chapter 2.

FIGURE 1–1 Primary and Secondary Market Transfer of Funds Time Line



harmful practices that have given rise to public concerns are "spinning" (in which certain underwriters allocate "hot" IPO issues to directors and/or executives of potential investment banking clients in exchange for investment banking business) and "biased" recommendations by research analysts whose compensation is tied to the success of their firms' investment banking business. This culminated in the spring of 2003 with an agreement between securities regulators and 10 of the nation's largest securities firms, in which they agreed to pay a record $1.4 billion in penalties to settle charges involving investor abuses (see the Ethical Debates box). The settlement centered on civil charges that securities firms routinely issued overly optimistic stock research to investors to gain favor with corporate clients and win their investment banking business. The agreement also settled charges that some major firms improperly allocated IPO shares to corporate executives to win investment banking business from their firms. The agreement has forced brokerage companies to make structural changes in the way they handle research—preventing, for example, analysts from attending certain meetings relating to investment banking.[2]

Secondary Markets. Once financial instruments such as stocks are issued in primary markets, they are then traded—that is, rebought and resold—in secondary markets. For example, on August 6, 2004, 10.9 million shares of ExxonMobil were traded in the secondary stock market. Buyers of secondary market securities are economic agents (consumers, businesses, and governments) with excess funds. Sellers of secondary market financial instruments are economic agents in need of funds. Secondary markets provide a centralized marketplace

2. Within days of this agreement, however, Bears Stearns, one of the 10 firms involved in the settlement, was accused of using its analysts to promote a new stock offering.

ETHICAL DEBATES

Street Braces for Revelations in Settlement

When Wall Street securities firms are bracing for a burst of e-mail messages and other documents suggesting that their stock research was tainted by investment-banking goals, as regulators put the finishing touches on the long-awaited $1.4 billion global research settlement, which is expected to be announced early next week . . . The pact's firm-by-firm allegations will include e-mails from Goldman telecom-sector analysts James Golob and Frank Governali, in which they candidly discuss how investment-banking considerations influenced many telecom stocks they were recommending in mid-2000 even as the stocks' prices were plummeting. Even Morgan Stanley . . . comes in for criticism for allowing some bullish research reports to sit for as long as six months without an update, according to one person familiar with the pact. The findings on Lehman will focus on four or five individuals, including both analysts and managers . . .

The Smith Barney unit of Citigroup, which is slated to pay a $400 million fine, the largest portion of the settlement, is expected to be subject voluntarily to a separate set of rules separating its research and investment-banking activities that are more stringent than for other firms involved in the settlement. Three firms paying the most—Citigroup, Merrill Lynch and the Credit Suisse First Boston (CFSB) unit of Credit Suisse Group—also could be hit with securities-fraud charges.

Merrill and CSFB have agreed to pay $200 million in settlement payment. Other firms are paying between $37.5 million and $125 million. The pact also generally includes rules separating research from investment banking; provision of independent research for individual investors; and more disclosure of research ratings and other data . . .

Source: *The Wall Street Journal*, April 25, 2003, p. C1, by Randall Smith, Susanne Craig, and Charles Gasparino. Reprinted by permission of *The Wall Street Journal*. © 2003 Dow Jones & Company, Inc. All Rights Reserved Worldwide. **www.wsj.com**

DO YOU UNDERSTAND?

3. What allegations were made by regulators against Wall Street securities firms with respect to their research and investment-banking activities?

where economic agents know they can transact quickly and efficiently. These markets therefore save economic agents the search and other costs of seeking buyers or sellers on their own. Figure 1–1 illustrates a secondary market transfer of funds. When an economic agent buys a financial instrument in a secondary market, funds are exchanged, usually with the help of a securities broker such as Schwab acting as an intermediary between the buyer and the seller of the instrument (see Chapter 9). The original issuer of the instrument (user of funds) is not involved in this transfer. The New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), and the National Association of Securities Dealers Automated Quotation (NASDAQ)[3] system are three well-known examples of secondary markets for trading stocks.[4] We discuss the details of each of these markets in Chapter 9. In addition to stocks and bonds, secondary markets also exist for financial instruments backed by mortgages and other assets (see Chapter 7), foreign exchange (see Chapter 8), and futures and options [i.e., **derivative securities**—financial securities whose payoffs are linked to other, previously issued (or underlying) primary securities (see Chapter 10)]. As we will see in Chapter 10, derivative securities have existed for centuries, but the growth in derivative securities markets occurred mainly in the 1970s, 1980s, and 1990s. As major markets, therefore, the derivative securities markets are among the newest of the financial security markets.

derivative security
A financial security whose payoffs are linked to other, previously issued securities.

secondary market
A market that trades financial instruments once they are issued.

Secondary markets offer benefits to both investors (suppliers of funds) and issuing corporations (users of funds). For investors, secondary markets provide the opportunity to trade securities at their market values quickly as well as to purchase securities with

3. On October 30, 1998, the National Association of Securities Dealers, Inc. (NASD), the world's first electronic stock market, and the American Stock Exchange (AMEX), the nation's second largest floor-based exchange, merged to form the Nasdaq-Amex Market Group. Due to a clash of cultures between the two institutions, the merger was dissolved after just one year.

4. Most bonds are not traded on floor-based exchanges. Rather, FIs trade them over the counter (OTC) using telephone and computer networks (see Chapter 6). For example, less than 1 percent of corporate bonds outstanding are traded on organized exchanges such as the NYSE.

varying risk-return characteristics (see Chapter 2). Corporate security issuers are not directly involved in the transfer of funds or instruments in the secondary market. However, the issuer does obtain information about the current market value of its financial instruments, and thus the value of the corporation as perceived by investors such as its stockholders, through tracking the prices at which its financial instruments are being traded on secondary markets. This price information allows issuers to evaluate how well they are using the funds generated from the financial instruments they have already issued and provides information on how well any subsequent offerings of debt or equity might do in terms of raising additional money (and at what cost).

Trading volume in secondary markets can be large. In the mid-1980s, a NYSE trading day involving 250 million shares was considered to be heavy. In the early 2000s this level of trading was considered quite light. For example, on October 28, 1997, NYSE trading volume exceeded 1 billion shares for the first time ever and trading of this magnitude has occurred several times since. Indeed, on July 24, 2002, trading volume topped 2.8 billion shares, the highest level to date.

Secondary markets offer buyers and sellers liquidity—the ability to turn an asset into cash quickly—as well as information about the prices or the value of their investments. Increased liquidity makes it more desirable and easier for the issuing firm to sell a security initially in the primary market. Further, the existence of centralized markets for buying and selling financial instruments allows investors to trade these instruments at low transaction costs.

2 Money Markets versus Capital Markets

Money Markets. **Money markets** are markets that trade debt securities or instruments with maturities of one year or less (see Figure 1–2). In the money markets, economic agents with short-term excess supplies of funds can lend funds (i.e., buy money market instruments) to economic agents who have short-term needs or shortages of funds (i.e., they sell money market instruments). The short-term nature of these instruments means that fluctuations in their prices in the secondary markets in which they trade are usually quite small (see Chapters 3 and 19 on interest rate risk). In the United States, money markets do not operate in a specific location—rather, transactions occur via telephones, wire transfers, and computer trading. Thus, most U.S. money markets are said to be **over-the-counter (OTC) markets.**

money markets

Markets that trade debt securities or instruments with maturities of less than one year.

over-the-counter markets

Markets that do not operate in a specific fixed location—rather, transactions occur via telephones, wire transfers, and computer trading.

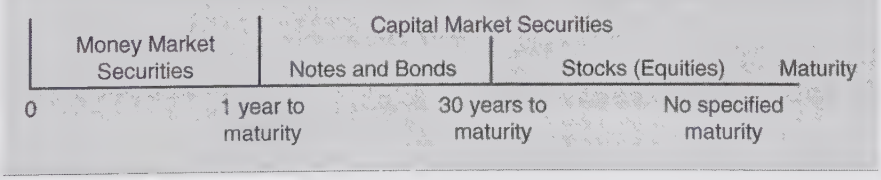
Money Market Instruments. A variety of money market securities are issued by corporations and government units to obtain short-term funds. These securities include Treasury bills, federal funds, repurchase agreements, commercial paper, negotiable certificates of deposit, and banker's acceptances. Figure 1–3 shows outstanding amounts of money market instruments in the United States in 1990, 2000, and 2004. Notice that in 2004 federal funds and repurchase agreements followed by commercial paper, negotiable CDs, and Treasury bills, had the largest amounts outstanding. Money market instruments and the operation of the money markets are described and discussed in detail in Chapter 5.

Capital Markets. **Capital markets** are markets that trade equity (stocks) and debt (bonds) instruments with maturities of more than one year (see Figure 1–2). The major suppliers of capital market securities (or users of funds) are corporations and governments.

capital markets

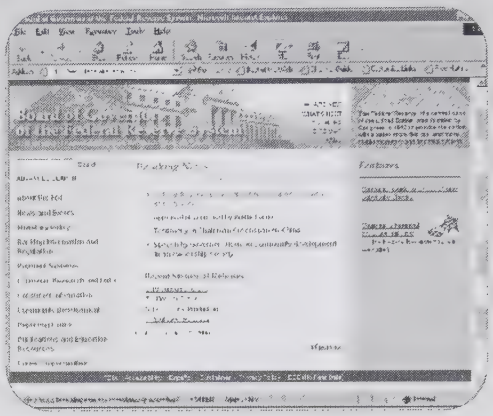
Markets that trade debt (bonds) and equity (stocks) instruments with maturities of more than one year.

FIGURE 1–2 Money versus Capital Market Maturities



SEARCH THE SITE

Go to the Board of Governors of the Federal Reserve Web site and find the latest information on money market and capital market instruments outstanding.



Go to the Federal Reserve Web site at **www.federalreserve.gov**

Click on "Economic Research and Data"

Click on "Statistics: Releases and Historical Data"

Click on "Quarterly Releases: Flow of Funds Accounts of the United States: Releases"

Click on "Current release"

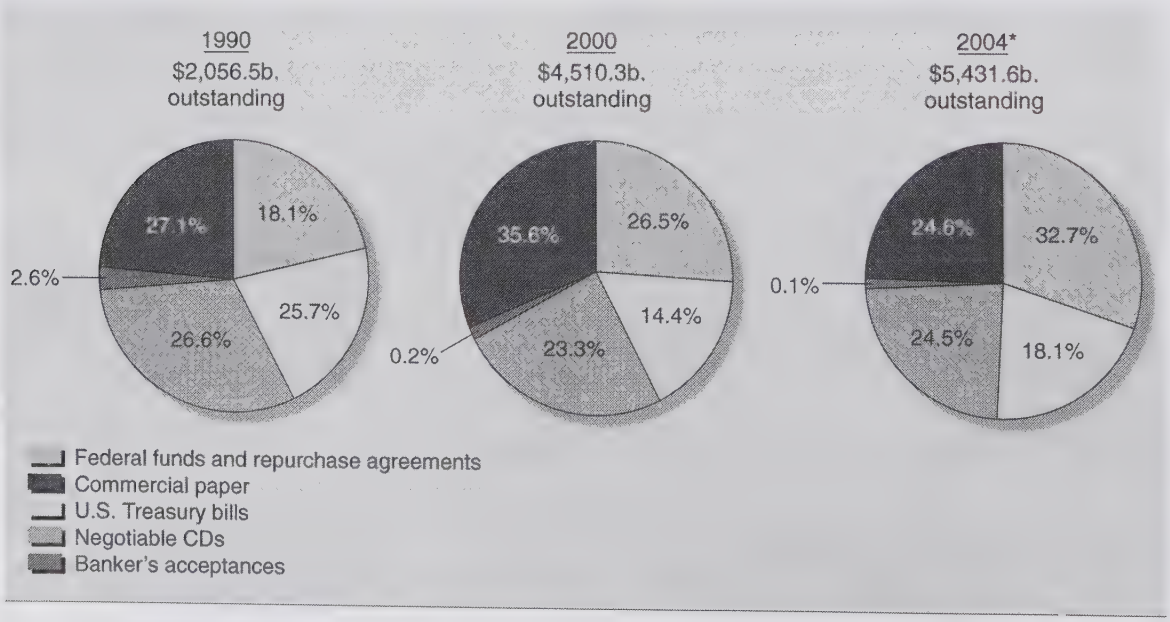
Click on "Level tables"

This will bring up the relevant tables. For example, federal funds and security repurchase agreements are listed in Table L.207; Commercial paper and bankers' acceptances are listed in Table L.208.

Questions

1. What is the most recent dollar value of commercial paper, banker's acceptances, and federal funds and repurchase agreements outstanding?
2. What is the percentage change in each of these since 1990? Since 2004?

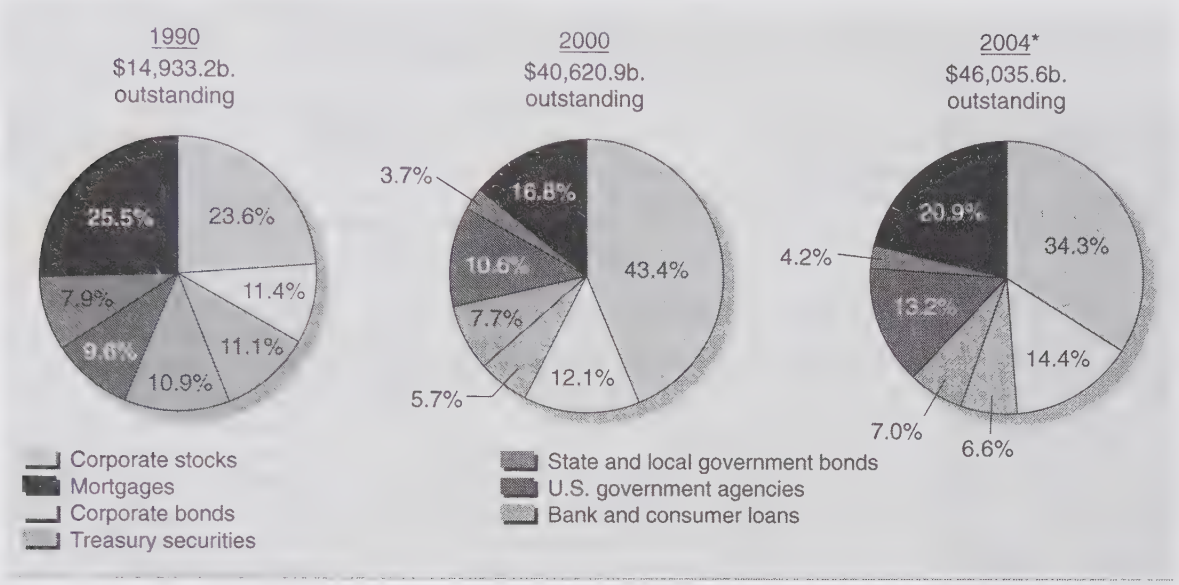
FIGURE 1–3 Money Market Instruments Outstanding



*As of the end of the first quarter.

Source: Federal Reserve Board, "Flow of Fund Accounts," *Statistical Releases*, Washington, DC, various issues. **www.federalreserve.gov**

FIGURE 1–4 Capital Market Instruments Outstanding



*As of the end of the first quarter.

Source: Federal Reserve Board, "Flow of Fund Accounts," *Statistical Releases,* Washington, DC, various issues. **www.federalreserve.gov**

Households are the major suppliers of funds for these securities. Given their longer maturity, these instruments experience wider price fluctuations in the secondary markets in which they trade than do money market instruments.[5] For example, all else constant, long-term maturity debt instruments experience wider price fluctuations for a given change in interest rates than short-term maturity debt instruments (see Chapter 3).

Capital Market Instruments. Figure 1–4 shows the major capital market instruments and their outstanding amounts by dollar market value. Notice that corporate stocks or equities represent the largest capital market instrument, followed by securitized mortgages and corporate bonds. Securitized mortgages are those mortgages that FIs have packaged together and sold as bonds backed by mortgage cash flows (such as interest and principal repayments—see Chapters 7 and 24). The relative size of the market value of capital market instruments outstanding depends on two factors: number of securities issued and their market prices.[6] One reason for the sharp increase in the value of equities outstanding is the bull market in stock prices in the 1990s. Values have fallen since 2000 as the U.S. economy experienced a downturn and stock prices fell. Capital market instruments and their operations are discussed in detail in Chapters 6, 7, and 9.

3 Foreign Exchange Markets

In addition to understanding the operations of domestic financial markets, a financial manager must also understand the operations of foreign exchange markets and foreign capital markets. Today's U.S.-based companies operate globally. It is therefore essential that financial managers understand how events and movements in financial markets in other countries affect the profitability and performance of their

5. For example, their longer maturities subject these instruments to both higher credit (or bankruptcy) risk and interest rate risk than money market instruments.

6. For example, the market value of equity is the product of the price of the equity times the number of shares that are issued.

own companies. For example, a currency and economic crisis in Argentina in late 2001 adversely impacted some U.S. markets and firms in the winter and spring of 2002. Coca Cola Co., which derived about 2 percent of its sales from Argentina, attributed a 5 percent decline in its 2002 operating profits to unfavorable currency movements between the Argentinian peso and the U.S. dollar.[7]

DO YOU UNDERSTAND?

Cash flows from the sale of securities (or other assets) denominated in a foreign currency expose U.S. corporations and investors to risk regarding the value at which foreign currency cash flows can be converted into U.S. dollars. For example, the actual amount of U.S. dollars received on a foreign investment depends on the exchange rate between the U.S. dollar and the foreign currency when the nondollar cash flow is converted into U.S. dollars. If a foreign currency depreciates (declines in value) relative to the U.S. dollar over the investment period (i.e., the period between the time a foreign investment is made and the time it is terminated), the dollar value of cash flows received will fall. If the foreign currency appreciates, or rises in value, relative to the U.S. dollar, the dollar value of cash flows received on the foreign investment will increase.

While foreign currency exchange rates are often flexible—they vary day to day with demand and supply of foreign currency for dollars—central governments sometimes intervene in foreign exchange markets directly or affect foreign exchange rates indirectly by altering interest rates. We discuss the motivation and effects of these interventions in Chapters 4 and 8. The sensitivity of the value of cash flows on foreign investments to changes in the foreign currency's price in terms of dollars is referred to as *foreign exchange risk* and is discussed in more detail in Chapter 8. Techniques for managing, or "hedging," foreign exchange risk, such as using derivative securities such as foreign exchange (FX) futures, options, and swaps, are discussed in Chapter 23.

Derivative Security Markets

4

Derivative security markets are the markets in which derivative securities trade. A **derivative security** is a financial security (such as a futures contract, option contract, or swap contract) whose payoff is linked to another, previously issued security such as a security traded in the capital or foreign exchange markets. Derivative securities generally involve an agreement between two parties to exchange a standard quantity of an asset or cash flow at a predetermined price and at a specified date in the future. As the value of the underlying security to be exchanged changes, the value of the derivative security changes. While derivative securities have been in existence for centuries, the growth in derivative security markets occurred mainly in the 1970s, 1980s, and 1990s. As major markets, therefore, the derivative security markets are the newest of the financial security markets. We discuss the tremendous growth of derivative security activity in Chapter 10. Derivative security traders can be either users of derivative contracts for hedging (see Chapters 10 and 23) and other purposes or dealers (such as banks) that act as counterparties in trades with customers for a fee.

derivative security markets

The markets in which derivative securities trade.

derivative security

An agreement between two parties to exchange a standard quantity of an asset at a predetermined price on a specified date in the future.

www.sec.gov

Financial Market Regulation

Financial instruments are subject to regulations imposed by regulatory agencies such as the Securities and Exchange Commission (SEC)—the main regulator of securities markets since the passage of the Securities Act of 1934—as well as the exchanges (if any) on which the instruments are traded. For example, the main emphasis of SEC regulations (as stated in the Securities Act of 1933) is on full and fair disclosure of information on securities issues to actual and potential investors. Those firms planning to issue new stocks or bonds to be sold to the public at large (public issues) are required by the SEC to register their securities with the SEC and to fully describe the issue, and any risks associated with the issue, in a legal document called a prospectus.[8] The SEC also monitors trading on the

7. See "U.S. Firms Assess Damage in Argentina," *The Wall Street Journal*, January 9, 2002, p. A10.

8. Those issues not offered to the public at large but rather sold to a few large investors are called private placements and are not subject to SEC regulations (see Chapter 6).

major exchanges (along with the exchanges themselves) to ensure that stockholders and managers do not trade on the basis of inside information about their own firms (i.e., information prior to its public release). SEC regulations are not intended to protect investors against poor investment choices but rather to ensure that investors have full and accurate information available about corporate issuers when making their investment decisions. The SEC has also imposed regulations on financial markets in an effort to reduce excessive price fluctuations. For example, the NYSE operates under a series of "circuit breakers" that require the market to shut down for a period of time when prices drop by large amounts during any trading day. The details of these circuit breaker regulations are listed in Chapter 9.

www.nyse.com

5 OVERVIEW OF FINANCIAL INSTITUTIONS

Financial institutions (e.g., commercial and savings banks, credit unions, insurance companies, mutual funds) perform the essential function of channeling funds from those with surplus funds (suppliers of funds) to those with shortages of funds (users of funds). Chapters 11 through 18 discuss the various types of FIs in today's economy, including (1) the size, structure, and composition of each type of FI, (2) their balance sheets and recent trends, (3) FI performance, and (4) the regulators who oversee each type of FI. Table 1–2 lists and summarizes the FIs discussed in detail in later chapters.

financial institutions
Institutions that perform the essential function of channeling funds from those with surplus funds to those with shortages of funds.

In Table 1–3, we show the changing shares of total assets of FIs in the United States from 1860 to 2004. A number of important trends are clearly evident; most apparent is the decline in the total share of depository institutions—commercial banks and thrifts—since World War II. Specifically, while still the dominant sector of the financial institutions

TABLE 1–2 Types of Financial Institutions

Commercial banks—depository institutions whose major assets are loans and whose major liabilities are deposits. Commercial banks' loans are broader in range, including consumer, commercial, and real estate loans, than are those of other depository institutions. Commercial banks' liabilities include more nondeposit sources of funds, such as subordinate notes and debentures, than do those of other depository institutions.

Thrifts—depository institutions in the form of savings associations, savings banks, and credit unions. Thrifts generally perform services similar to commercial banks, but they tend to concentrate their loans in one segment, such as real estate loans or consumer loans.

Insurance companies—financial institutions that protect individuals and corporations (policyholders) from adverse events. Life insurance companies provide protection in the event of untimely death, illness, and retirement. Property casualty insurance protects against personal injury and liability due to accidents, theft, fire, and so on.

Securities firms and investment banks—financial institutions that underwrite securities and engage in related activities such as securities brokerage, securities trading, and making a market in which securities can trade.

Finance companies—financial intermediaries that make loans to both individuals and businesses. Unlike depository institutions, finance companies do not accept deposits but instead rely on short- and long-term debt for funding.

Mutual funds—financial institutions that pool financial resources of individuals and companies and invest those resources in diversified portfolios of asset.

Pension funds—financial institutions that offer savings plans through which fund participants accumulate savings during their working years before withdrawing them during their retirement years. Funds originally invested in and accumulated in a pension fund are exempt from current taxation.

TABLE 1-3 Percentage Shares of Assets of Financial Institutions in the United States, 1860–2004

	1860	1880	1900	1912	1922	1929	1939	1949	1960	1970	1980	1990	2000	2004†
Commercial banks	71.4%	60.6%	62.9%	64.5%	63.3%	53.7%	51.2%	55.9%	38.2%	37.9%	34.8%	36.8%	35.7%	35.3%
Thrift institutions	17.8	22.8	18.2	14.8	13.9	14.0	13.6	12.3	19.7	20.4	21.4	16.5	10.0	10.6
Insurance companies	10.7	13.9	13.8	16.6	16.7	18.6	27.2	24.3	23.8	18.9	16.1	18.2	16.8	17.6
Investment companies	—	—	—	—	0.0	2.4	1.9	1.3	2.9	3.5	3.6	9.5	17.0	17.0
Pension funds	—	—	0.0	0.0	0.0	0.7	2.1	3.1	9.7	13.0	17.4	11.2	10.7	9.1
Finance companies	—	0.0	0.0	0.0	0.0	2.0	2.2	2.0	4.6	4.8	5.1	5.8	5.8	5.5
Securities brokers and dealers	0.0	0.0	3.8	3.0	5.3	8.1	1.5	1.0	1.1	1.2	1.1	1.3	3.6	4.2
Mortgage companies	0.0	2.7	1.3	1.2	0.8	0.6	0.3	0.1	*	*	0.4	0.6	0.2	0.2
Real estate investment trusts	—	—	—	—	—	—	—	—	0.0	0.3	0.1	0.1	0.2	0.5
Total (percent)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total (trillion dollars)	.001	.005	.016	.034	.075	.123	.129	.281	.596	1.328	4.025	8.122	14.650	17.936

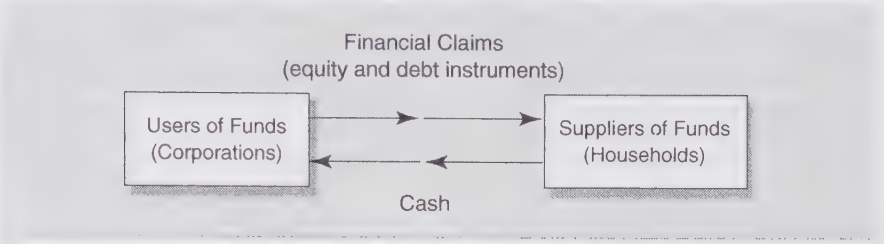
Columns may not add to 100% due to rounding.

*Data not available.

†As of June 2004.

Source: Randall Kroszner, "The Evolution of Universal Banking and Its Regulation in Twentieth Century America," in *Universal Banking Financial System Design Reconsidered*, ed. Anthony Saunders and Ingo Walter (Burr Ridge, IL: Irwin, 1996); and Federal Reserve Board, "Flow of Funds Accounts," *Statistical Releases*, various issues. **www.federalreserve.gov**

FIGURE 1–5 Flow of Funds in a World without FIs



industry, the share of commercial banks declined from 55.9 to 35.3 percent between 1948 and 2004, as the share of thrifts (savings banks, savings associations, and credit unions) fell from 12.3 to 10.6 percent over the same period.[9] Similarly, insurance companies also witnessed a decline in their share, from 24.3 to 17.6 percent. The most dramatic trend involves the increasing share of pension funds and investment companies. Pension funds (private plus state and local) increased their asset share from 3.1 to 9.1 percent, while investment companies (mutual funds and money market mutual funds) increased their share from 1.3 to 17.0 percent over the 1948 to 2004 period.

To understand the important economic function FIs play in the operation of financial markets, imagine a simple world in which FIs did not exist. In such a world, suppliers of funds (e.g., households), generating excess savings by consuming less than they earn, would have a basic choice: They could either hold cash as an asset or directly invest that cash in the securities issued by users of funds (e.g., corporations or households). In general, users of funds issue financial claims (e.g., equity and debt securities) to finance the gap between their investment expenditures and their internally generated savings such as retained earnings. As shown in Figure 1–5, in such a world we have a **direct transfer** of funds (money) from suppliers of funds to users of funds. In return, financial claims would flow directly from users of funds to suppliers of funds.

direct transfer

A corporation sells its stock or debt directly to investors without going through a financial institution.

In this economy without FIs, the level of funds flowing between suppliers of funds (who want to maximize the return on their funds subject to risk) and users of funds (who want to minimize their cost of borrowing subject to risk) through financial markets is likely to be quite low. There are several reasons for this. Once they have lent money in exchange for financial claims, suppliers of funds need to monitor continuously the use of their funds. They must be sure that the user of funds neither steals the funds outright nor wastes the funds on projects that have low or negative returns, since this would lower the chances of being repaid and/or earning a positive return on their investment (such as through the receipt of dividends or interest). Such monitoring is often extremely costly for any given fund supplier because it requires considerable time, expense, and effort to collect this information relative to the size of the average fund supplier's investment.[10]

9. Although commercial bank assets as a percentage of total assets in the financial sector may have declined in recent years, this does not necessarily mean that banking activity has decreased. Indeed, off-balance-sheet activities have replaced some of the more traditional on-balance-sheet activities of commercial banks (see Chapter 12). Further, as is discussed in Part Three of the text, banks are increasingly providing services (such as securities underwriting, insurance underwriting and sales, and mutual fund services) previously performed exclusively by other FIs.

10. Failure to monitor exposes fund suppliers to "agency costs," that is, the risk that the fund users will take actions with the fund supplier's money contrary to the promises contained in the financing agreement. Monitoring costs are part of overall agency costs. That is, agency costs arise whenever economic agents enter into contracts in a world of asymmetric or incomplete information and thus information collection is costly. The more difficult and costly it is to collect information, the more likely it is that contracts will be broken. In this case the fund suppliers could be harmed by the actions taken by the fund users. As discussed below, one solution to this agency problem is for a large number of fund suppliers to place their funds with a single FI who acts as a "delegated" monitor.

As mentioned earlier, the SEC requires and monitors the full and fair disclosure of information on securities to actual or potential investors (suppliers of funds)—such as in quarterly and annual reports. Many investors, however, do not have the financial training to analyze this information in order to determine whether a securities issuer is making the best use of its funds. Further, such a large number of investment opportunities are available to fund suppliers that even those trained in financial analysis rarely have the time to monitor the use of funds for all of their investments. Given this, fund suppliers would likely prefer to leave, or delegate, the monitoring of fund borrowers to others. The resulting lack of monitoring increases the risk of directly investing in financial claims.

The relatively long-term nature of many financial claims (e.g., mortgages, corporate stock, and bonds) creates a second disincentive for suppliers of funds to hold the direct financial claims issued by users of funds. Specifically, given the choice between holding cash and long-term securities, fund suppliers may well choose to hold cash for **liquidity** reasons, especially if they plan to use their savings to finance consumption expenditures in the near future and financial markets are not very developed, or deep, in terms of the number of active buyers and sellers in the market. Moreover, even though real-world financial markets provide some liquidity services, by allowing fund suppliers to trade financial securities among themselves, fund suppliers face a **price risk** upon the sale of securities. In addition, the secondary market trading of securities involves various transaction costs. The price at which investors can sell a security on secondary markets such as the New York Stock Exchange (NYSE) may well differ from the price they initially paid for the security either because investors change their valuation of the security between the time it was bought and when it was sold and/or because dealers, acting as intermediaries between buyers and sellers, charge transaction costs for completing a trade.[11]

liquidity
The ease with which an asset can be converted into cash.

price risk
The risk that an asset's sale price will be lower than its purchase price.

Unique Economic Functions Performed by Financial Institutions

Because of (1) monitoring costs, (2) liquidity costs, and (3) price risk, the average investor may view direct investment in financial claims and markets as an unattractive proposition and prefer to hold cash. As a result financial market activity (and therefore savings and investment) would likely remain quite low.

However, the financial system has developed an alternative and indirect way for investors (or fund suppliers) to channel funds to users of funds.[12] This is the **indirect transfer** of funds to the ultimate user of funds via FIs. Due to the costs of monitoring, liquidity risk, and price risk, as well as for other reasons explained later, fund suppliers often prefer to hold the financial claims issued by FIs rather than those directly issued by the ultimate users of funds. Consider Figure 1–6, which is a closer representation than Figure 1–5 of the world in which we live and the way funds flow in the U.S. financial system. Notice how financial intermediaries or institutions are standing, or intermediating between, the suppliers and users of funds—that is, channeling funds from ultimate suppliers to ultimate users of funds.

indirect transfer
A transfer of funds between suppliers and users of funds through a financial intermediary.

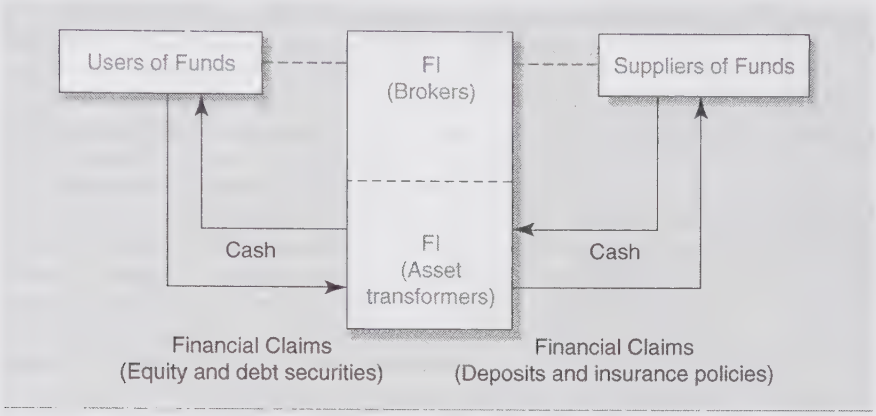
How can an FI reduce the monitoring costs, liquidity risks, and price risks facing the suppliers of funds compared to when they directly invest in financial claims? We look at how FIs resolve these cost and risk issues next and summarize them in Table 1–4.

Monitoring Costs. As mentioned above, a supplier of funds who directly invests in a fund user's financial claims faces a high cost of monitoring the fund user's actions in a timely and complete fashion. One solution to this problem is for a large number of small investors to group their funds together by holding the claims issued by an FI. In turn the FI

11. On organized exchanges such as the NYSE, the price difference between a buy and sell price is called the bid-ask spread.

12. We describe and illustrate this flow of funds in Chapter 2.

FIGURE 1–6 Flow of Funds in a World with FIs



invests in the direct financial claims issued by fund users. This aggregation of funds by fund suppliers in an FI resolves a number of problems. First, the "large" FI now has a much greater incentive to hire employees with superior skills and training in monitoring and who will use this expertise to collect information and monitor the ultimate fund user's actions because the FI has far more at stake than any small individual fund supplier. Second, the monitoring function performed by the FI alleviates the "free-rider" problem that exists when small fund suppliers leave it to each other to collect information and monitor a fund user. In an economic sense, fund suppliers have appointed the FI as a **delegated monitor** to act on their behalf. For example, full-service securities firms such as Morgan Stanley

delegated monitor

An economic agent appointed to act on behalf of smaller investors in collecting information and/or investing funds on their behalf.

TABLE 1–4 Services Performed by Financial Intermediaries

Services Benefiting Suppliers of Funds

Monitoring Costs—Aggregation of funds in an FI provides greater incentive to collect a firm's information and monitor actions. The relatively large size of the FI allows this collection of information to be accomplished at a lower average cost (economies of scale).

Liquidity and Price Risk—FIs provide financial claims to household savers with superior liquidity attributes and with lower price risk.

Transaction Cost Services—Similar to economies of scale in information production costs, an FI's size can result in economies of scale in transaction costs.

Maturity Intermediation—FIs can better bear the risk of mismatching the maturities of their assets and liabilities.

Denomination Intermediation—FIs such as mutual funds allow small investors to overcome constraints to buying assets imposed by large minimum denomination size.

Services Benefiting the Overall Economy

Money Supply Transmission—Depository institutions are the conduit through which monetary policy actions impact the rest of the financial system and the economy in general.

Credit Allocation—FIs are often viewed as the major, and sometimes only, source of financing for a particular sector of the economy, such as farming and residential real estate.

Intergenerational Wealth Transfers—FIs, especially life insurance companies and pension funds, provide savers with the ability to transfer wealth from one generation to the next.

Payment Services—Efficiency with which depository institutions provide payment services directly benefits the economy.

carry out investment research on new issues and make investment recommendations for their retail clients (or investors), while commercial banks collect deposits from fund suppliers and lend these funds to ultimate users such as corporations. An important part of these FIs' functions is their ability and incentive to monitor ultimate fund users.

asset transformers

Financial claims issued by an FI that are more attractive to investors than are the claims directly issued by corporations.

Liquidity and Price Risk. In addition to improving the quality and quantity of information, FIs provide further claims to fund suppliers, thus acting as **asset transformers.** FIs purchase the financial claims issued by users of funds—primary securities such as mortgages, bonds, and stocks—and finance these purchases by selling financial claims to household investors and other fund suppliers in the form of deposits, insurance policies, or other *secondary securities*.

Often claims issued by FIs have liquidity attributes that are superior to those of primary securities. For example, banks and thrift institutions (e.g., savings associations) issue transaction account deposit contracts with a fixed principal value and often a guaranteed interest rate that can be withdrawn immediately, on demand, by investors. Money market mutual funds issue shares to household savers that allow them to enjoy almost fixed principal (depositlike) contracts while earning higher interest rates than on bank deposits, and that can be withdrawn immediately by writing a check. Even life insurance companies allow policyholders to borrow against their policies held with the company at very short notice. How can FIs such as depository institutions offer highly liquid, low price-risk securities to fund suppliers on the liability side of their balance sheets while investing in relatively less liquid and higher price-risk securities—such as the debt and equity—issued by fund users on the asset side? Furthermore, how can FIs be confident enough to guarantee that they can provide liquidity services to fund suppliers when they themselves invest in risky assets? Indeed, why should fund suppliers believe FIs' promises regarding the liquidity and safety of their investments?

diversify

The ability of an economic agent to reduce risk by holding a number of securities in a portfolio.

The answers to these three questions lie in FIs' ability to **diversify** away some, but not all, of their investment risk. The concept of diversification is familiar to all students of finance. Basically, as long as the returns on different investments are not perfectly positively correlated, by spreading their investments across a number of assets, FIs can diversify away significant amounts of their portfolio risk. (We discuss the mechanics of diversification in the loan portfolio in Chapter 20.) Indeed, experiments in the United States and the United Kingdom have shown that diversifying across just 15 securities can bring significant diversification benefits to FIs and portfolio managers.[13] Further, for equal investments in different securities, as the number of securities in an FI's asset portfolio increases, portfolio risk falls, albeit at a diminishing rate. What is really going on here is that FIs can exploit the law of large numbers in making their investment decisions, whereas because of their smaller wealth size, individual fund suppliers are constrained to holding relatively undiversified portfolios. As a result, diversification allows an FI to predict more accurately its expected return and risk on its investment portfolio so that it can credibly fulfill its promises to the suppliers of funds to provide highly liquid claims with little price risk. A good example of this is a bank's ability to offer highly liquid, instantly withdrawable demand deposits as liabilities while investing in risky, nontradable, and often illiquid loans as assets. As long as an FI is large enough to gain from diversification and monitoring on the asset side of its balance sheet, its financial claims (its liabilities) are likely to be viewed as liquid and attractive to small savers—especially when compared to direct investments in the capital market.

Additional Benefits FIs Provide to Suppliers of Funds

The indirect investing of funds through FIs is attractive to fund suppliers for other reasons as well. We discuss these below and summarize them in Table 1–4.

13. For a review of such studies, see E. J. Elton and M. J. Gruber, *Modern Portfolio Theory and Investment Analysis*, 6th ed. (New York: John Wiley & Sons, 1998), Chapter 2.

economies of scale

The concept that cost reduction in trading and other transaction services results from increased efficiency when FIs perform these services.

etrade

Buying and selling shares on the Internet.

Reduced Transaction Cost. Not only do FIs have a greater incentive to collect information, but also their average cost of collecting relevant information is lower than for the individual investor (i.e., information collection enjoys **economies of scale**). For example, the cost to a small investor of buying a $100 broker's report may seem inordinately high for a $10,000 investment. For an FI with $10 billion of assets under management, however, the cost seems trivial. Such economies of scale of information production and collection tend to enhance the advantages to investors of investing via FIs rather than directly investing themselves.

Nevertheless, as a result of technological advances, the costs of direct access to financial markets by savers are ever falling and the relative benefits to the individual savers of investing through FIs are narrowing. An example is the ability to reduce transactions costs with an **etrade** on the Internet rather than use a traditional stockbroker and paying brokerage fees (see Chapter 9). Another example is the private placement market, in which corporations such as General Electric sell securities directly to investors often without using underwriters. In addition, a number of companies allow investors to buy their stock directly without using a broker. Among well-known companies that have instituted such stock purchase plans are AT&T, Microsoft, Marathon Oil, IBM, Walt Disney Co., and Tribune Co., a Chicago-based entertainment and media company.

Maturity Intermediation. An additional dimension of FIs' ability to reduce risk by diversification is their greater ability to bear the risk of mismatching the maturities of their assets and liabilities than can small savers. Thus, FIs offer maturity intermediation services to the rest of the economy. Specifically, by maturity mismatching, FIs can produce new types of contracts such as long-term mortgage loans to households, while still raising funds with short-term liability contracts such as deposits. In addition, although such mismatches can subject an FI to interest rate risk (see Chapters 3 and 19), a large FI is better able than a small investor to manage this risk through its superior access to markets and instruments for hedging the risks of such loans (see Chapters 7, 10, 20, and 24).

Denomination Intermediation. Some FIs, especially mutual funds, perform a unique service because they provide services relating to denomination intermediation. Because many assets are sold in very large denominations, they are either out of reach of individual savers or would result in savers holding very undiversified asset portfolios. For example, the minimum size of a negotiable CD is $100,000, while commercial paper (short-term corporate debt) is often sold in minimum packages of $250,000 or more. Individual small savers may be unable to purchase such instruments directly. However, by buying shares in a mutual fund with other small investors, small savers overcome constraints to buying assets imposed by large minimum denomination size. Such indirect access to these markets may allow small savers to generate higher returns (and lower risks) on their portfolios as well.

Economic Functions FIs Provide to the Financial System as a Whole

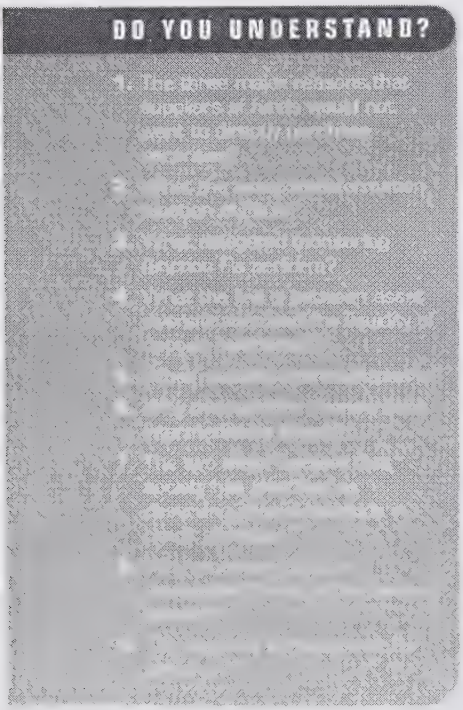
In addition to the services FIs provide to suppliers and users of funds in the financial markets, FIs perform services that improve the operation of the financial system as a whole. We discuss these next and summarize them in Table 1–4.

The Transmission of Monetary Policy. The highly liquid nature of bank and thrift deposits has resulted in their acceptance by the public as the most widely used medium of exchange in the economy. Indeed, at the core of the three most commonly used definitions of the money supply (see Chapter 4) are bank and/or thrift deposit contracts. Because deposits are a significant component of the money supply, which in turn directly impacts the rate of inflation, depository institutions—particularly commercial banks—play a key role in the *transmission of monetary policy* from the central bank (the Federal Reserve) to the rest of the economy (see Chapter 4 for a detailed discussion of how the Federal Reserve implements

www.federalreserve.gov

monetary policy through depository institutions).[14] Because depository institutions are instrumental in determining the size and growth of the money supply, depository institutions have been designated as the primary conduit through which monetary policy actions by the Federal Reserve impact the rest of the financial sector and the economy in general.

Credit Allocation. Additionally, FIs provide a unique service to the economy in that they are the major source of financing for particular sectors of the economy preidentified by society as being in special need of financing. For example, policymakers in the United States and a number of other countries such as the United Kingdom have identified *residential real estate* as needing special attention. This has enhanced the specialness of those FIs that most commonly service the needs of that sector. In the United States, savings associations and savings banks must emphasize mortgage lending. Sixty-five percent of their assets must be mortgage related for these thrifts to maintain their charter status (see Chapter 14). In a similar fashion, farming is an especially important area of the economy in terms of the overall social welfare of the population. Thus, the U.S. government has directly encouraged financial institutions to specialize in financing this area of activity through the creation of Federal Farm Credit Banks.[15]



Intergenerational Wealth Transfers or Time Intermediation. The ability of savers to transfer wealth from their youth to old age as well as across generations is also of great importance to a country's social well-being. Because of this, special taxation relief and other subsidy mechanisms encourage investments by savers in life insurance, annuities, and pension funds. For example, pension funds offer savings plans through which fund participants accumulate tax exempt savings during their working years before withdrawing them during their retirement years.

Payment Services. Depository institutions such as banks and thrifts are also special in that the efficiency with which they provide payment services directly benefits the economy. Two important payment services are check-clearing and wire transfer services. For example, on any given day, over $3 trillion of payments are directed through Fedwire and CHIPS, the two largest wholesale payment wire network systems in the United States. Any breakdowns in these systems would likely produce gridlock to the payment system, with resulting harmful effects to the economy.

Risks Incurred by Financial Institutions

As FIs perform the various services described above, they face many types of risk. Specifically, all FIs hold some assets that are potentially subject to default or credit risk (such as loans, stocks, and bonds). As FIs expand their services to non-U.S. customers or even domestic customers with business outside the United States, they are exposed to both foreign exchange risk and country or sovereign risk as well. Further, FIs tend to mismatch the maturities of their balance sheet assets and liabilities to a greater or lesser extent and are thus exposed to interest rate risk. If FIs actively trade these assets and liabilities rather than hold them for longer-term investments, they are further exposed to market risk or asset price risk. Increasingly, FIs hold contingent assets and liabilities off the balance sheet, which presents an additional risk called off-balance-sheet risk. Moreover, all FIs are exposed to some degree of liability withdrawal or liquidity risk, depending on the type of claims they have sold to liability holders. All FIs are exposed to technology

14. The Federal Reserve is the U.S. central bank charged with promoting economic growth in line with the economy's potential to expand, and in particular, stable prices.

15. The Farm Credit System was created by Congress in 1916 to provide American agriculture with a source of sound, dependable credit at low rates of interest.

TABLE 1–5 Risks Faced by Financial Institutions

1. **Credit Risk**—risk that promised cash flows from loans and securities held by FIs may not be paid in full.
2. **Foreign Exchange Risk**—risk that exchange rate changes can affect the value of an FI's assets and liabilities located abroad.
3. **Country or Sovereign Risk**—risk that repayments from foreign borrowers may be interrupted because of interference from foreign governments.
4. **Interest Rate Risk**—risk incurred by an FI when the maturities of its assets and liabilities are mismatched.
5. **Market Risk**—risk incurred in trading assets and liabilities due to changes in interest rates, exchange rates, and other asset prices.
6. **Off-Balance-Sheet Risk**—risk incurred by an FI as the result of activities related to contingent assets and liabilities.
7. **Liquidity Risk**—risk that a sudden surge in liability withdrawals may require an FI to liquidate assets in a very short period of time and at low prices.
8. **Technology Risk**—risk incurred by an FI when its technological investments do not produce anticipated cost savings.
9. **Operational Risk**—risk that existing technology or support systems may malfunction or break down.
10. **Insolvency Risk**—risk that an FI may not have enough capital to offset a sudden decline in the value of its assets.

risk and operational risk because the production of financial services requires the use of real resources and back-office support systems (labor and technology combined to provide services). Finally, the risk that an FI may not have enough capital reserves to offset a sudden loss incurred as a result of one or more of the risks they face creates insolvency risk for the FI.[16] Chapters 19 through 24 provide an analysis of how FIs measure and manage these risks. We summarize the various risks in Table 1–5.

Regulation of Financial Institutions

The preceding section showed that FIs provide various services to sectors of the economy. Failure to provide these services, or a breakdown in their efficient provision, can be costly to both the ultimate suppliers of funds and users of funds as well as to the economy overall. For example, bank failures may destroy household savings and at the same time restrict a firm's access to credit. Insurance company failures may leave household members totally exposed in old age to the cost of catastrophic illnesses and to sudden drops in income on retirement. In addition, individual FI failures may create doubts in savers' minds regarding the stability and solvency of FIs and the financial system in general and cause panics and even withdrawal runs on sound institutions. FIs are regulated in an attempt to prevent these types of market failures and the costs they would impose on the economy and society at large. Although regulation may be socially beneficial, it also imposes private costs, or a regulatory burden, on individual FI owners and managers. Consequently, regulation is an attempt to enhance the social welfare benefits and mitigate the costs of the provision of FI services.

While many regulations restrict competition among industry participants or restrict activities FIs may undertake, recent U.S. regulatory changes have been deregulatory in nature. That is, they have expanded the activities and degree of competition allowed to FIs. As a result, the traditional activities of various institutions have been eroding and many FIs are altering and refining their range of activities. Chapter 13 describes the regulations (past and present) that have been imposed on U.S. FIs.

16. As discussed in Chapter 12, the capital reserves of an FI insulate it against the losses that may occur as a result of its risk exposure.

GLOBALIZATION OF FINANCIAL MARKETS AND INSTITUTIONS

Financial markets and institutions in the United States have their counterparts in many foreign countries. Table 1–6 lists U.S. dollar equivalent values of money market and debt securities outstanding in countries throughout the world from 1996 through 2004. Notice that U.S. markets dominate the world debt markets. For example, in 2004 over 26 percent of the world's debt securities were issued in the United States. The next two most active issuers combined (Germany and the United Kingdom) had fewer debt securities outstanding than the U.S. market. While U.S. financial markets have historically been much larger in value size and trading volume than any foreign market, financial markets became truly global in the 1980s as technological improvements resulted in more immediate and cheaper access to real-time data worldwide by domestic and international investors. As a result the volume and values of stocks and other securities traded in foreign markets soared. For example, the value of stocks traded in the Japanese stock market has, at times, exceeded that of stocks traded in the United States. Likewise, foreign bond markets have served as a major source of international capital. For example, **Eurodollar bonds** are dollar-denominated bonds issued mainly in London and other European centers such as Luxembourg. Since they are issued outside U.S. territory,

Eurodollar bond

Dollar-denominated bonds issued mainly in London and other European centers such as Luxembourg.

TABLE 1–6 World Financial Markets, International Debt Outstanding, by Issuer

(in billions of dollars)

	Long-Term Debt			Money Market Securities	
Country	1996	1999	2004*	1999	2004*
Argentina	$ 29.0	$ 62.6	$ 87.3	$ 0.4	$ 0.1
Australia	77.4	90.0	179.1	13.1	27.7
Austria	62.5	75.6	169.9	4.5	6.8
Belgium	42.1	61.5	232.6	5.6	21.7
Brazil	23.1	42.9	87.7	3.4	2.2
Canada	177.8	217.1	266.7	5.1	3.4
France	204.4	298.0	700.4	10.4	30.0
Germany	319.8	623.7	1,846.7	60.1	140.8
Hong Kong	15.9	25.5	49.6	12.3	0.6
Ireland	20.0	26.3	97.1	2.9	17.2
Italy	88.6	147.9	534.6	7.9	18.3
Japan	325.6	332.3	264.0	6.0	16.0
Luxembourg	8.4	13.9	34.7	4.4	3.3
Mexico	41.5	61.2	75.4	1.8	0.3
Netherlands	112.2	196.3	539.9	23.5	49.3
Norway	19.5	32.4	62.7	0.8	1.8
South Korea	38.9	49.0	66.2	0.7	2.1
Spain	44.2	107.7	396.5	9.4	13.1
Sweden	99.6	93.4	148.2	4.7	13.9
Switzerland	39.5	80.9	173.0	4.4	15.5
United Kingdom	258.7	436.7	1,085.6	33.6	99.3
United States	372.4	1,286.7	3,118.4	24.1	78.3
Total private sector debt	$2,982.5	$5,105.5	$11,455.8	$260.0	$595.7

*As of the end of the first quarter.

Source: Bank for International Settlements, "International Banking and Financial Market Developments," *Quarterly Review*, various issues. **www.bis.org**

TABLE 1–7 Financial Market Securities Holdings
(in billions of dollars)

	1992	1996	2000	2004*
U.S. Financial Market Instruments Held by Foreign Investors				
Open market paper	$ 12.9	$ 57.9	$ 111.0	$ 158.6
U.S. government securities	595.0	1,293.9	1,772.4	2,361.5
U.S. corporate bonds	251.5	453.2	1,003.9	1,611.6
Loans to U.S. corporate businesses	129.9	126.2	117.3	111.9
Total	989.3	1,931.2	3,004.6	4,243.6
U.S. corporate equities held	329.0	656.8	1,748.3	1,655.4
Total financial assets held	$2,247.0	$4,133.2	$7,369.1	$8,426.6
Foreign Financial Market Instruments Held by U.S. Investors				
Commercial paper	$ 78.4	$ 67.5	$ 120.9	$ 190.0
Bonds	147.2	347.7	504.7	376.9
Bank loans	23.9	43.7	70.7	58.9
U.S. government loans	55.1	50.1	47.3	41.5
Acceptance liabilities to banks	11.3	9.9	3.1	0.0
Total	315.8	518.8	746.7	667.3
Foreign corporate equities held	314.3	876.8	1,787.0	2,040.1
Total financial assets held	$1,712.3	$3,117.0	$5,286.5	$5,295.1

*As of the end of the first quarter.

Source: Federal Reserve Board, "Flow of Fund Accounts," *Statistical Releases*, various issues.
www.federalreserve.gov

Eurodollar bonds are not required to be registered with the U.S. SEC (the regulator of domestic securities' issues). Eurodollar bonds account for over 80 percent of new issues in the international bond market. Globalization of financial markets is also evident in the derivative securities markets (discussed in Chapter 10). Eurodollar futures and options contracts (futures and options in which the underlying index is the three-month Eurodollar deposit rate or the LIBOR rate) are major contributors to these markets, often dominating in terms of the number of contracts and notional value outstanding.[17]

The significant growth in foreign financial markets is the result of several factors. First is the increase in the pool of savings in foreign countries (e.g., the European Union). Second, international investors have turned to U.S. and other markets to expand their investment opportunities and improve their investment portfolio risk and return characteristics. This is especially so as the retirement value of public pension plans has declined in many European countries and investors have turned to private pension plans to boost their long-term savings. Third, information on foreign investments and markets is now more accessible and thorough—for example, via the Internet. Fourth, some U.S. FIs—such as specialized mutual funds—offer their customers opportunities to invest in foreign securities and emerging markets at relatively low transaction costs. Finally, deregulation in many foreign countries has allowed international investors greater access and allowed the deregulating countries to expand their investor bases (e.g., until 1997, foreign investors faced severe restrictions on their ability to buy Korean stocks). As a result of these factors, the overall volume of investment and trading activity in foreign securities is increasing, as is the integration of U.S. and foreign financial markets.

Table 1–7 shows the extent of the growth in foreign investment in U.S. financial markets. From 1992 through 2004, foreign investors' holdings of U.S. financial market

17. For example, on August 4, 2004, 1,070,329 Eurodollar futures contracts were traded on the Chicago Mercantile Exchange, each with a face value of $1 million. U.S. Treasury note futures, each with a face value of $100,000, were the second most active financial future traded, with a volume of 625,360 contracts.

TABLE 1–8 The Largest (in Total Assets) Banks in the World
(in billions of dollars)

Bank	Country	Total Assets
1. Mizuho Financial	Japan	$1,285,471
2. Citigroup	United States	1,264,032
3. UBS Group	Switzerland	1,120,543
4. Crédit Agricole Group	France	1,105,378
5. HSBC Holdings	United Kingdom	1,034,216

Source: *The Banker*, July 1, 2004. **www.thebanker.com**

debt securities outstanding increased 329 percent, from $989.3 billion to $4,243.6 billion, while foreign financial market debt securities held by U.S. investors increased 111 percent, from $315.8 billion to $667.3 billion. From these data it should be evident that while U.S. financial markets dominate world markets, the growth of U.S. financial markets depends more and more on the growth and development of other economies. In turn, the success of other economies depends to a significant extent on their financial market development.

For the same reasons discussed earlier (i.e., monitoring costs, liquidity risk, and price risk), financial institutions are of central importance to the development and integration of markets globally. However, U.S. FIs must now compete not only with other domestic FIs for a share of these markets but increasingly with foreign FIs. Table 1–8 lists the five largest banks in the world, measured by total assets, as of 2004. Only one of these banks is a U.S. bank. Figure 1–7 shows foreign bank offices' assets and liabilities held in the United States from 1992 through 2004. Total foreign bank assets over this period increased from $509.3 billion to $789.4 billion in 2000 before falling back to $736.6 billion in 2004.

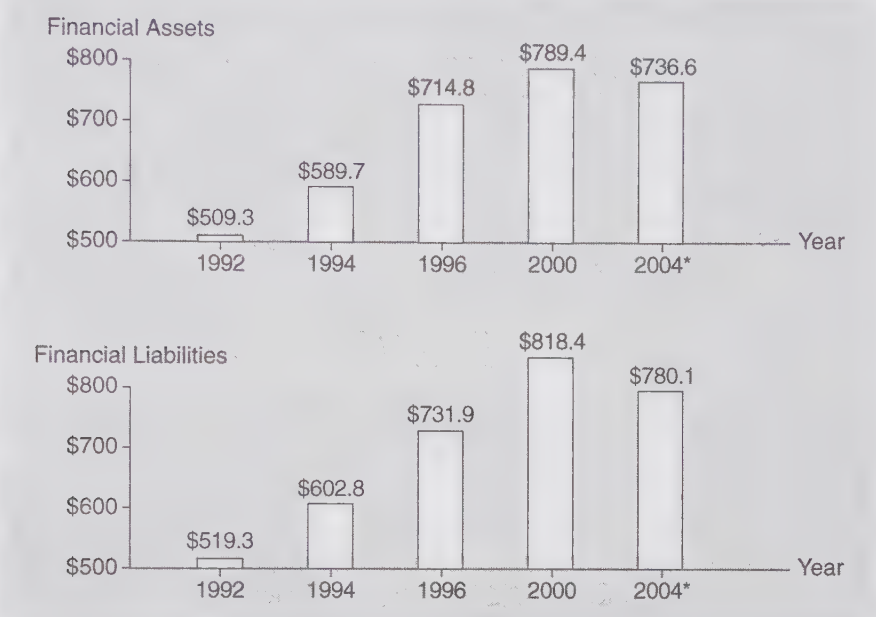
The world's most active five banks, on the basis of the percentage of their assets held outside their home countries, are listed in Table 1–9. These include the big Swiss banks (Union Bank of Switzerland and Credit Suisse) as well as one U.S. bank, American Express Bank. Interestingly, although in 2004 Japanese banks occupied 4 of the top 20 banks in the world in terms of asset size, they are absent from the list of banks with the most active international operations. Indeed, domestic problems, including record bad loans (especially in real estate) and a recession, induced Japanese banks to contract their foreign assets and international activities, as well as to merge. For example, in July 2004 Mitsubishi Tokyo Financial Group (Japan's second largest bank) announced that it would seek a merger with UFJ Holdings (Japan's fourth largest bank). The merger created the

TABLE 1–9 Top Global Banks

Bank	Home Country	Percentage of Overseas Business*
1. American Express Bank	United States	86.2%
2. Union Bank of Switzerland	Switzerland	84.4
3. Arab Banking Corporation	Bahrain	82.3
4. Credit Suisse	Switzerland	79.6
5. Standard Charter	United Kingdom	69.6

*Overseas business refers to the percentage of assets banks hold outside their home country.
Source: "Top Global Banks," *The Banker*, February 2003. **www.thebanker.com**

FIGURE 1–7 **Foreign Bank Offices Assets and Liabilities Held in the United States**
(in billions of dollars)



*As of the end of the first quarter.

Source: Federal Reserve Board, "Flow of Fund Accounts," *Statistical Releases,* various issues.
www.federalreserve.gov

world's largest bank with $1.7 trillion in assets.[18] Chapter 13 discusses regulatory differences among countries' FIs and recent changes toward implementing a regulatory "level playing field."

DO YOU UNDERSTAND?

As a result of the increased globalization of financial markets and institutions, U.S. financial market movements now have a much greater impact on foreign markets than historically. For example, on August 6, 2004, a much weaker than expected increase in new jobs in the United States and record high oil prices sent financial markets around the world reeling. After these announcements the Dow Jones Industrial Average (DJIA) in the United States fell by 1.5 percent, the Financial Times Stock Exchange (FTSE) in the United Kingdom fell 1.7 percent, and the Deutsche Aktienindex (DAX) in Germany fell 2.7 percent. Moreover, foreign financial market movements also have a much greater impact on U.S. markets. For example, on May 15, 2004, as oil prices climbed above $40 a barrel for the first time in 13 years, stock markets fell sharply worldwide. Japan's Nikkei Index fell by 5 percent, the Dow Jones Industrial Average fell below 10,000 for the first time since December 2003, and London's FTSE stock market index suffered its steepest one-day drop in over a year. Thus, the ability of managers to maximize value for an FI's shareholders not only depends on their knowledge of the operations of domestic financial markets and institutions but increasingly on their knowledge of the operations of overseas financial markets and institutions.

18. This bank began formal consolidated operations in 2005.

SUMMARY

This introductory chapter reviewed the basic operations of domestic and foreign financial markets and institutions. It described the ways in which funds flow through an economic system from lenders to borrowers and outlined the markets and instruments that lenders and borrowers employ to complete this process. In addition, the chapter discussed the need for FI managers to understand the functioning of both the domestic as well as the international markets in which they participate.

The chapter also identified the various factors impacting the specialness of the services FIs provide and the manner in which they improve the efficiency with which funds flow from suppliers of funds to the ultimate users of funds. Currently, however, some forces—such as technology and especially the Internet—are so powerful that in the future FIs that have historically relied on making profits by performing traditional special functions such as brokerage will need to expand the array of financial services they sell as well as the way that such services are distributed or sold to their customers.

SEARCH THE SITE

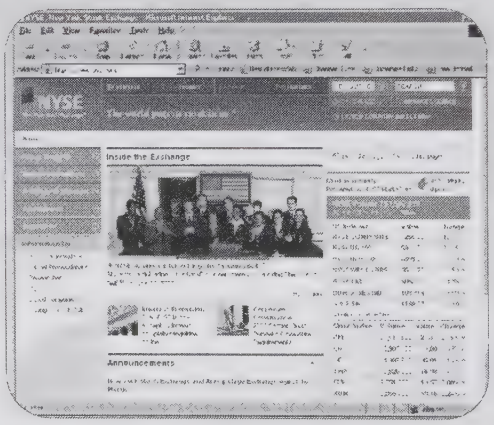
Go to the New York Stock Exchange Web site at **www.nyse.com** and find the latest figures for top NYSE volume days.

Click on "Market Information"

Click on "Data Library"

Click on "Reported Share Volume Records"

This brings up a file that contains the relevant data.



Questions

1. What is the largest number of daily shares traded on the NYSE? On what day did this occur?
2. Calculate the percentage change in daily trading volume since the 2.8 billion shares traded on July 24, 2002.

QUESTIONS

1. Classify the following transactions as taking place in the primary or secondary markets:
   a. IBM issues $200 million of new common stock.
   b. The New Company issues $50 million of common stock in an IPO.
   c. IBM sells $5 million of GM preferred stock out of its marketable securities portfolio.
   d. The Magellan Fund buys $100 million of previously issued IBM bonds.
   e. Prudential Insurance Co. sells $10 million of GM common stock.
2. Classify the following financial instruments as money market securities or capital market securities:
   a. Bankers Acceptances
   b. Commercial Paper
   c. Common Stock
   d. Corporate Bonds
   e. Mortgages
   f. Negotiable Certificates of Deposit
   g. Repurchase Agreements
   h. U.S. Treasury Bills
   i. U.S. Treasury Notes
   j. Federal Funds
3. How does the location of the money market differ from that of the capital market?
4. Which of the money market instruments has grown fastest since 1990?
5. What are the major instruments traded in capital markets?
6. Why did public confidence in the integrity of the IPO process erode in the early 2000s? What did regulators do to try to reestablish trust?

7. STANDARD &POOR'S Go to the S&P Educational Version of Market Insight Web site at **www.mhhe.com/edumarketinsight.** Use the following steps to identify the dollar amount of common stock outstanding for ExxonMobil (XOM). Click on "Educational Version of Market Insight." Enter your Site ID and click on "Login." Click on "Company." In the box marked "Ticker" enter XOM and click on "Go!" Click on "Financial Highlights." This brings up a file that contains the relevant data.
8. If a U.S. bank is holding Japanese yen in its portfolio, what type of exchange rate movement would the bank be most concerned about?
9. What are the different types of financial institutions? Include a description of the main services offered by each.
10. How would economic transactions between suppliers of funds (e.g., households) and users of funds (e.g., corporations) occur in a world without FIs?
11. Why would a world limited to the direct transfer of funds from suppliers of funds to users of funds likely result in quite low levels of fund flows?
12. How do FIs reduce monitoring costs associated with the flow of funds from fund suppliers to fund investors?
13. How do FIs alleviate the problem of liquidity risk faced by investors wishing to invest in securities of corporations?
14. How do financial institutions help individuals to diversify their portfolio risks? Which financial institution is best able to achieve this goal?
15. What is meant by maturity intermediation?
16. What is meant by denomination intermediation?
17. What services do FIs provide to the financial system?
18. Why are FIs regulated?
19. STANDARD &POOR'S Go to the S&P Educational Version of Market Insight Web site at **www.mhhe.com/edumarketinsight.** Use the following steps to identify the Industry Description and Industry Constituents for the following industries: Diversified Banks, Investment Banking & Brokerage, Life & Health Insurance, and Property & Casualty Insurance. Click on "Educational Version of Market Insight." Enter your Site ID and click on "Login." Click on "Industry." From the Industry list, select (one at a time) "Diversified Banks," "Investment Banks & Brokerage," "Life & Health Insurance," and "Property & Casualty." Click on "Go!" Click on "Industry Profile" and, separately, "Industry Constituents." How do the number of firms and the assets sizes of firms vary by industry?
20. What countries have the most international debt securities outstanding?
21. What countries have the largest commercial banks?

Chapter 2

Determinants *of* Interest Rates

OUTLINE

Chapter NAVIGATOR

1. How are interest rates used to determine present and future values?
2. Who are the main suppliers of loanable funds?
3. Who are the main demanders of loanable funds?
4. How are equilibrium interest rates determined?
5. What factors cause the supply and demand curves for loanable funds to shift?
6. How do interest rates change over time?
7. What specific factors determine interest rates?
8. What are the different theories explaining the term structure of interest rates?
9. How can forward rates of interest be derived from the term structure of interest rates?

INTEREST RATE FUNDAMENTALS: CHAPTER OVERVIEW

Nominal interest rates are the interest rates actually observed in financial markets. These nominal interest rates (or just interest rates) directly affect the value (price) of most securities traded in the money and capital markets, both at home and abroad. As will be discussed later, they affect the relationship between spot and forward foreign exchange rates as well.

Changes in interest rates influence the performance and decision making for individual investors, businesses, and governmental units alike. Figure 2–1 illustrates the movement in several key U.S. interest rates over the past 30 years: the prime commercial loan rate, the three-month T-bill rate, the high-grade corporate bond rate, and the

FIGURE 2–1A Key U.S. Interest Rates, 1972–2004

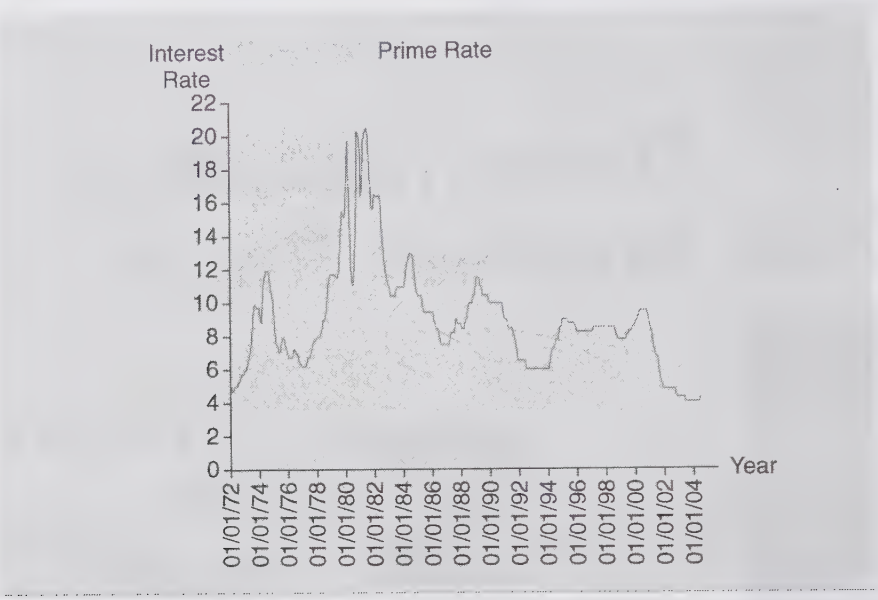
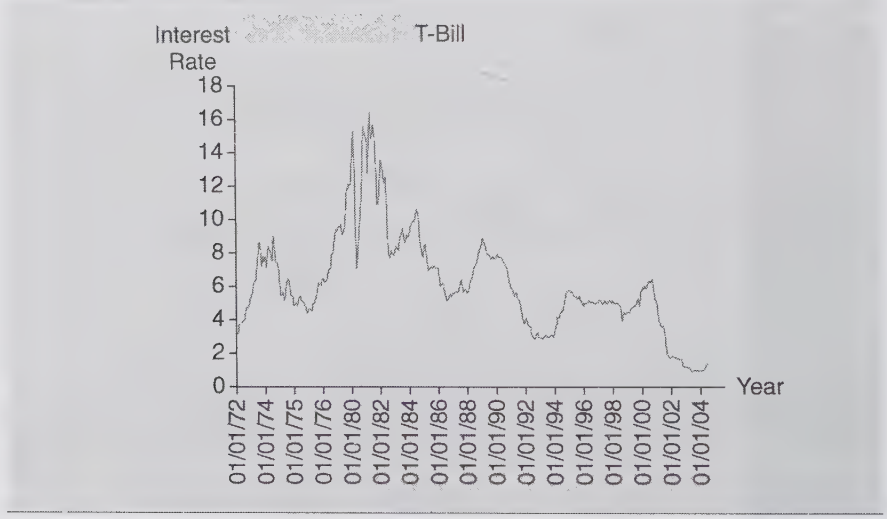


FIGURE 2–1B



Source: Federal Reserve Board Web site, August 2004. **www.federalreserve.gov**

nominal interest rates

The interest rates actually observed in financial markets.

home mortgage rate. Notice in Figure 2–1 the variability over time in interest rate levels. For example, the prime rate hit highs of over 20 percent in the early 1980s, yet was as low as 4.75 percent in the early 1970s, was well below 10 percent throughout much of the 1990s, and fell back to 4.00 percent in the early 2000s.

This chapter examines the link between the time value of money and interest rates, as well as the factors that drive the level of current and future interest rates. Sections 1 through 6 (as listed in the Chapter Navigator) generally deal with the levels of interest rates, while Sections 7 through 9 are more concerned with differences among various interest rates.

FIGURE 2–1C

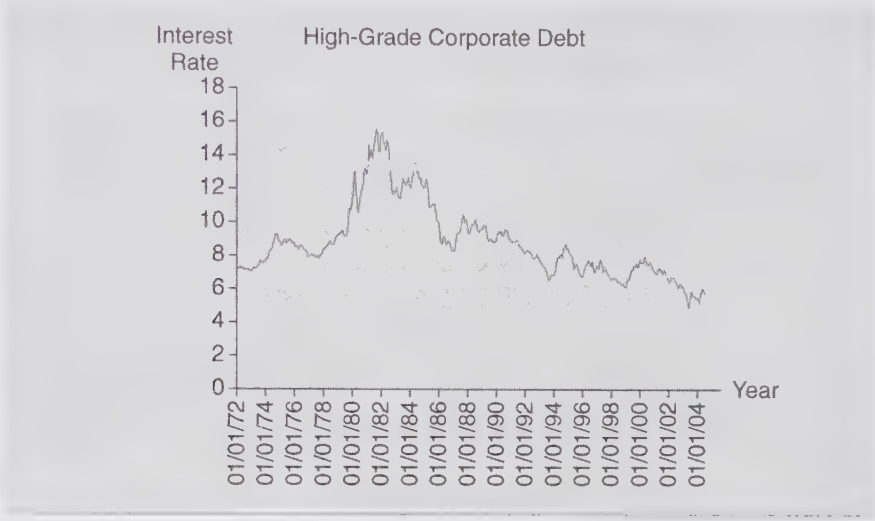


FIGURE 2–1D

1 TIME VALUE OF MONEY AND INTEREST RATES[1]

Chapter 1 introduced the different types of financial markets that exist and the securities that trade in these markets. Interest rates have a direct and immediate effect on the value of virtually all of these securities—that is, interest rates affect the price or value the seller

1. The time value of money concept is a topic that finance students probably studied in introductory financial management courses. However, its use in the valuation of financial instruments created, traded, and held by financial institutions is critical to financial managers. Therefore, in this chapter, we review and provide a reference guide to the general relationships between interest rates and security valuation. This material can be included or dropped from the chapter reading, depending on the need for review of the material, without harming the continuity of the chapter. In Chapter 3, we use these general relationships to determine values of specific securities (e.g., equities and bonds).

of a security receives and the buyer of a security pays in organized financial markets. In this section, we review the time value of money concepts that link interest rates to the valuation of securities.

Time Value of Money

Time value of money is the basic notion that a dollar received today is worth more than a dollar received at some future date. This is because a dollar received today can be invested and its value enhanced by an interest rate or return such that the investor receives more than a dollar in the future. The interest rate or return reflects the fact that people generally prefer to consume now rather than wait until later. To compensate them for delaying consumption (i.e., saving), they are paid a rate of interest by those who wish to consume more today than their current resources permit (users of funds). Dissavers are willing to pay this rate of interest because they plan to productively use the borrowed funds such that they will earn even more than the rate of interest promised to the savers (suppliers of the funds).

The time value of money concept specifically assumes that any interest or other return earned on a dollar invested over any given period of time (e.g., two, three, four, . . . years) is immediately reinvested—that is, the **interest** return is **compounded.** This is in contrast to the concept of **simple interest,** which assumes that interest returns earned are not reinvested over any given time period.

compound interest
Interest earned on an investment is reinvested.

simple interest
Interest earned on an investment is not reinvested.

EXAMPLE 2–1 Calculation of Simple and Compounded Interest Returns

CALCULATION OF SIMPLE INTEREST RETURN

Suppose you have $1,000 to invest for a period of two years. Currently, default risk-free one-year securities (such as those issued by the U.S. Treasury) are paying a 12 percent interest rate per year, on the last day of each of the two years over your investment horizon. If you earn simple annual interest on this investment, or you do not reinvest the annual (12 percent) interest earned, the value of your investment at the end of the first year is:

$$\begin{aligned}\text{Value in 1 year (simple interest)} &= \text{Principal} + \text{Interest (year 1)}\\ &= \$1{,}000 + \$1{,}000(.12) = \$1{,}000 + \$120\\ &= \$1{,}000(1.12) = \$1{,}120\end{aligned}$$

With simple interest, the $120 in interest earned in year 1 is *not* reinvested in year 2. Rather, you take the $120 in interest out of the investment account and hold it until the end of year 2. Only the original $1,000 investment is carried forward and earns interest in year 2. Thus, the value at the end of the two-year investment horizon is:

$$\begin{aligned}\text{Value in 2 years (simple interest)} &= \text{Principal} + \text{Interest (year 1)} + \text{Interest (year 2)}\\ &= \$1{,}000 + \$1{,}000(.12) + \$1{,}000(.12)\\ &= \$1{,}000 + \$1{,}000(.12)2 = \$1{,}240\end{aligned}$$

Panel A of Figure 2–2 illustrates the value of the investment over the two-year investment horizon using simple interest.

CALCULATION OF COMPOUNDED INTEREST RETURN

If, instead, the annual interest earned is reinvested immediately after it is received at 12 percent (i.e., interest is compounded), the value of the investment at the end of the first year is:

$$\begin{aligned}\text{Value in 1 year (compounded interest)} &= \text{Principal} + \text{Interest (year 1)}\\ &= \$1{,}000 + \$1{,}000(.12) = \$1{,}000 + \$120\\ &= \$1{,}000(1.12) = \$1{,}120\end{aligned}$$

Notice that after the first year of the two-year investment horizon, you have $1,120 whether the investment earns simple or compounded interest. With compounded interest, however, the $120 in interest earned in year 1 is reinvested in year 2. Thus, the whole $1,120 is carried forward and earns interest in year 2. In this case, the value of the investment at the end of the two-year investment horizon is:

$$\begin{aligned}\text{Value in 2 years (compound interest)} &= \text{Principal} + \text{Interest (year 1)} + \text{Interest on original principal (year 2)} + \text{Compounded interest (or interest on interest received in year 1)}\\ &= \$1{,}000 + \$1{,}000(.12) + \$1{,}000(.12) + 1{,}000(.12)(.12)\\ &= \$1{,}000[1 + 2(.12) + (.12)^2] = \$1{,}000(1.12)^2\\ &= \$1{,}254.40\end{aligned}$$

Panel B of Figure 2–2 illustrates the value of the investment over the two-year investment horizon using compounded interest. By compounding interest using time value of money principles, an investor increases his or her return compared to the simple interest return. In the example above using a two-year investment horizon, a 12 percent annual interest rate, and an initial investment of $1,000, the investment is worth $1,254.40 at the end of two years under compounded returns rather than $1,240 using simple interest to calculate returns.

The time value of money concept can be used to convert cash flows earned over an investment horizon into a value at the end of the investment horizon. This is called the investment's future value (*FV*) and is the same as that in the compounded return example above.

FIGURE 2–2 Value of a Two-Year Investment Using Simple Versus Compounded Interest

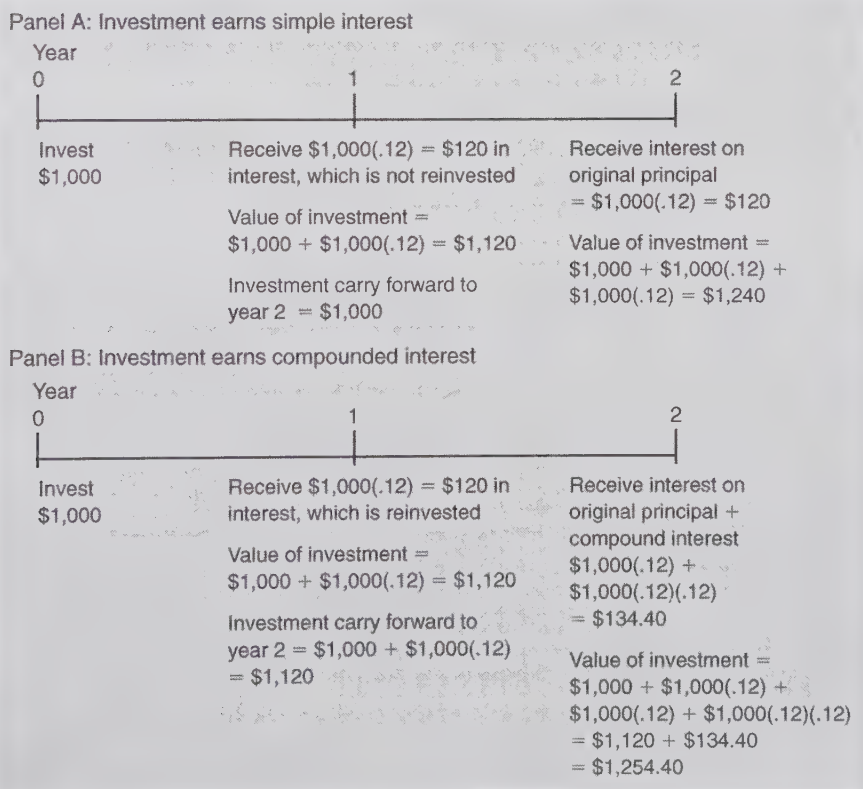
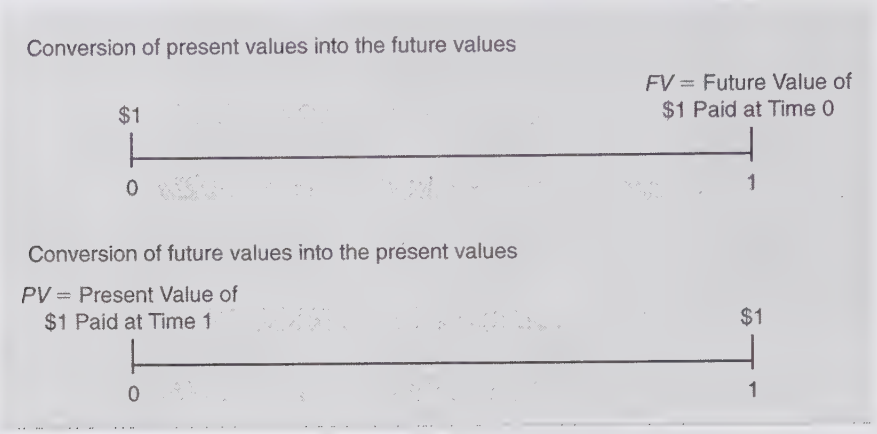


FIGURE 2–3 Time Value of Money Concepts



Alternatively, the time value of money concept can be used to convert the value of future cash flows into their current or present values (*PV*) (i.e., future dollars converted into their equivalent present value or current dollars). We illustrate the *FV* and *PV* scenarios in Figure 2–3. Two forms of time value of money calculations are commonly used in finance for security valuation purposes: the value of a lump sum and the value of annuity payments. A **lump sum payment** is a single cash payment received at the beginning or end of some investment horizon (e.g., $100 at the end of five years). **Annuity** payments are a series of equal cash flows received at fixed intervals over the entire investment horizon (e.g., $100 a year received each year for five years). In actual practice, "annuity" payments can be paid more frequently than once a year—so that the term *annuity* really means a constant payment received at equal intervals throughout an investment horizon (e.g., twice, three times, . . . a year). We first discuss lump sum time value of money calculations, followed by annuity calculations.

lump sum payment

A single cash flow occurs at the beginning and end of the investment horizon with no other cash flows exchanged.

annuity

A series of equal cash flows received at fixed intervals over the investment horizon.

Lump Sum Valuation

Present Value of a Lump Sum. The present value function converts cash flows received over a future investment horizon into an equivalent (present) value as if they were received at the beginning of the current investment horizon. This is done by discounting future cash flows back to the present using the current market interest rate. The time value of money equation used to calculate this value is illustrated in Figure 2–4 and can be represented as follows.

Present value (*PV*) of a *lump sum* received at the end of the investment horizon, or future value (*FV*):

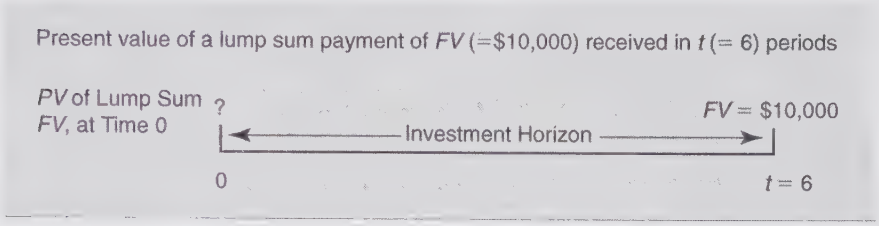
$$PV = FV_t\,[1/(1 + r)]^t = FV_t(PVIF_{r,t}) \quad \textbf{(1)}$$

where

PV = Present value of cash flows
FV_t = Future value of cash flows (lump sum) received in t periods
r = Interest rate earned per period on an investment (equals the nominal annual interest rate, i, divided by the number of compounding periods per year—(e.g., daily, weekly, monthly, quarterly, semiannually)
t = Number of compounding periods in the investment horizon (equals the number of years in the investment horizon times the number of compounding periods per year)
$PVIF_{r,t}$ = Present value interest factor[2] of a lump sum = $[1/(1 + r)]^t$

2. Interest factor formulas are programmed in business calculators—a tool with which every finance student should be familiar. Because there are several variations of business calculators, we do not apply the problems in the text to any one brand of calculator.

FIGURE 2–4 **Present Value of a Lump Sum**
(invested at the rate of r per period)



EXAMPLE 2-2 Calculation of Present Value of a Lump Sum

You have been offered a security investment such as a bond that will pay you $10,000 at the end of six years in exchange for a fixed payment today (see Figure 2–4). If the appropriate annual interest rate on the investment is 8 percent compounded annually, the present value of this investment is computed as follows:

$$PV = FV(PVIF_{r,t}) = \$10{,}000\ (PVIF_{8\%,6}) = \$10{,}000\ (.630170) = \$6{,}301.70$$

If the annual interest rate on the investment rises to 12 percent, the present value of this investment becomes:

$$PV = \$10{,}000\ (PVIF_{12\%,6}) = \$10{,}000\ (.506631) = \$5{,}066.31$$

If the annual interest rate on the investment rises to 16 percent, the present value of this investment becomes:

$$PV = \$10{,}000\ (PVIF_{16\%,6}) = \$10{,}000\ (.410442) = \$4{,}104.42$$

Finally, if the annual interest rate on the investment of 16 percent is compounded semiannually (that is, you will receive $t = 12$ (6×2) total interest payments, each calculated as $r = 8$ percent (16 percent ÷ 2) times the principal value in the investment, where r in this case is the semiannual interest payment) rather than annually, the present value of this investment becomes:

$$PV = \$10{,}000\ (PVIF_{8\%,12}) = \$10{,}000\ (.397114) = \$3{,}971.14$$

Notice from the previous examples that the *present values* of the security investment *decrease as interest rates increase.* For example, as the interest rate rose from 8 percent to 12 percent, the (present) value of the security investment fell $1,235.39 (from $6,301.70 to $5,066.31). As interest rates rose from 12 percent to 16 percent, the value of the investment fell $961.89 (from $5,066.31 to $4,104.42). This is because as interest rates increase, fewer funds need to be invested at the beginning of an investment horizon to receive a stated amount at the end of the investment horizon. This inverse relationship between the value of a financial instrument—for example, a bond—and interest rates is one of the most fundamental relationships in finance and is evident in the swings that occur in financial asset prices whenever major changes in interest rates arise. Indeed, even the hint of an announcement of a change in interest rate targets by the chairman of the Federal Reserve Board (the Fed) (see Chapter 4 for an explanation of when and why the Fed changes interest rate targets) can send financial markets around the world reeling (see In the News box).

Note also that *as interest rates increase,* the *present values* of the investment *decrease at a decreasing rate.* The fall in present value is greater when interest rates rise by 4 percent, from 8 percent to 12 percent, compared to when they rise from 12 percent to 16 percent—the inverse relationship between interest rates and the present value of security investments is neither linear nor proportional.

IN THE NEWS

Wall Street Takes Heart from Greenspan's Words

Waning worries about inflation fuelled a rally on Wall Street yesterday after economic data and a testimony from the Federal Reserve chairman calmed speculation about aggressive rises in interest rates. Alan Greenspan, the Fed chief, repeated that any tightening in monetary policy was "likely to be measured" while a reading of inflation met forecasts.

With two hours to go, the S&P 500 index put on 0.9 percent to 1,135.83 while the Dow Jones Industrial Average added 0.7 percent at 10,405.78. The tech-laden Nasdaq Composite gained 1.8 percent to 2,005.25. While the consumer price index rose at the fastest rate since January 2001, the core CPI, that excludes volatile energy and food expenses, rose only 0.2 percent, in line with expectation . . .

However, the focus was on Mr. Greenspan, who told the Senate that the US central bank anticipates a gradual need to raise borrowing costs. Recent data and other Fed officials' speeches had prompted speculation that Mr. Greenspan and colleagues might be forced to be more aggressive and some economists expected a half-point rise in rates when the Fed meets to decide the matter in two weeks . . .

Higher trading volumes than Wall Street has seen recently fanned hopes that this time, the momentum would last. Mr. Greenspan's testimony overshadowed a busier day for corporate news than the markets have seen in a while, with a few stocks having a significant impact on their respective sectors.

Source: *The Financial Times Limited*, June 16, 2004, p. 48, by Andrei Postolnicu. **www.ft.com**

DO YOU UNDERSTAND?

Finally, from this example notice that the greater the number of compounding periods per year (i.e., semiannually versus annually), the smaller the present value of a future amount.[3]

Future Value of a Lump Sum. The future value of a lump sum equation translates a cash flow received at the beginning of an investment period to a terminal (future) value at the end of an investment horizon (e.g., 5 years, 6 years, 10 years, etc.). The future value (FV) equation is illustrated in Figure 2–5 and can be represented as follows:

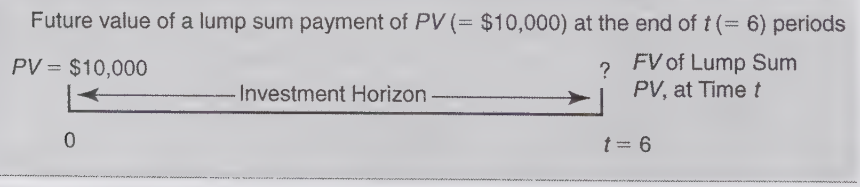
Future value of a lump sum received at the beginning of the investment horizon:

$$FV_t = PV(1 + r)^t = PV\,(FVIF_{r,t}) \tag{2}$$

where

$FVIF_{r,t}$ = Future value interest factor of a lump sum = $(1 + r)^t$

FIGURE 2–5 Future Value of a Lump Sum
(invested at the rate of r *per period)*



3. The ultimate of compounding periods is instantaneous, or continuous, compounding over the investment horizon (period). In this case the present value formula becomes:

$$PV = FV_n[1/(1 + i/\infty)]^{n\infty} = FV_n(e^{-in})$$

where n is the number of years in the investment horizon (period). Thus, in Example 2–2, if the annual interest rate on the investment is 16 percent compounded continuously, the present value of the $10,000 investment is six years is:

$$PV = \$10{,}000\ (e^{-.16 \times 6}) = \$10{,}000\ (.382893) = \$3{,}828.93$$

EXAMPLE 2–3 Calculation of Future Value of a Lump Sum

You plan to invest $10,000 today in exchange for a fixed payment at the end of six years (see Figure 2–5). If the appropriate annual interest rate on the investment is 8 percent compounded annually, the future value of this investment is computed as follows:

$$FV = PV\,(FVIF_{r,t}) = \$10{,}000\,(FVIF_{8\%,6}) = \$10{,}000\,(1.586874) = \$15{,}868.74$$

If the annual interest rate on the investment rises to 12 percent, the future value of this investment becomes:

$$FV = \$10{,}000\,(FVIF_{12\%,6}) = \$10{,}000\,(1.973823) = \$19{,}738.23$$

If the annual interest rate on the investment rises to 16 percent, the future value of this investment becomes:

$$FV = \$10{,}000\,(FVIF_{16\%,6}) = \$10{,}000\,(2.436396) = \$24{,}363.96$$

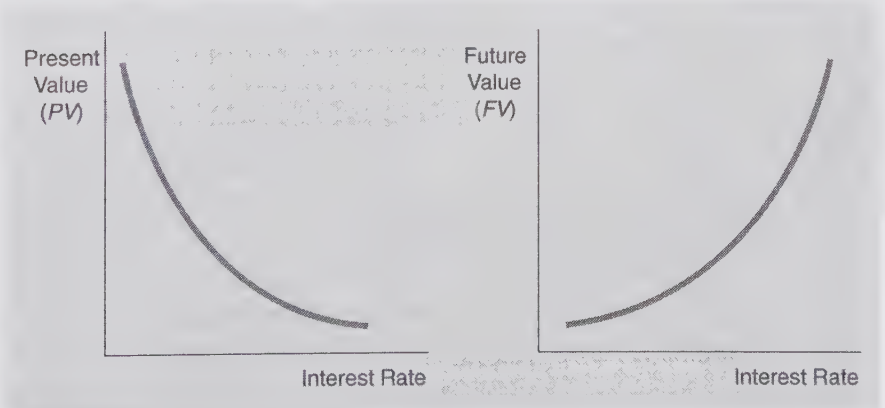
Finally, if the annual interest rate on the investment of 16 percent is compounded semiannually rather than annually (i.e., $r = 16\%/2 = 8\%$ and $t = 6 \times 2 = 12$), the future value of this investment becomes:

$$FV = \$10{,}000\,(FVIF_{8\%,12}) = \$10{,}000\,(2.518170) = \$25{,}181.70$$

Notice that the *future value* of an investment *increases as interest rates increase.* As interest rates rose from 8 percent to 12 percent, the (future) value of the investment of $10,000 for six years rose by $3,869.49 (from $15,868.74 to $19,738.23). As rates rose from 12 percent to 16 percent, the (future) value of the investment rose $4,625.73 (from $19,738.23 to $24,363.96). Note also that *as interest rates increase, future values increase at an increasing rate.*[4] This is because as interest rates increase, a stated amount of funds invested at the beginning of an investment horizon accumulates to a larger amount at the end of the investment horizon. This is due to the compounding of interest returns. By contrast, as stated earlier, as interest rates increase, the present value of an investment decreases at a decreasing rate. These nonlinear relationships are illustrated in Figure 2–6.

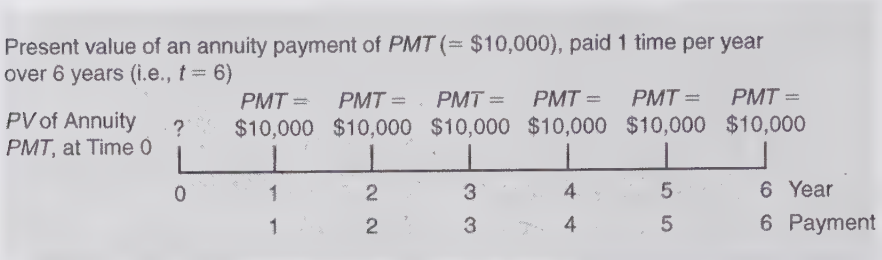
Finally, notice that as the number of compounding periods per year increases, the *future value* of a present amount increases.

FIGURE 2–6 Relation between Interest Rates and Present and Future Values



4. That is, as rates go from 8 percent to 12 percent (an increase in interest rates of 4 percent), the future value increases by $3,869.49; as interest rates go from 12 percent to 16 percent (an increase in interest rates of 4 percent), the future value increases by $4,625.73.

FIGURE 2–7 **Present Value of an Annuity**
(invested at the rate of r per period)



Annuity Valuation

Present Value of an Annuity. The present value of an annuity equation converts a series of equal cash flows received at equal intervals throughout the investment horizon into an equivalent (present) value as if they were received at the beginning of the investment horizon. The time value of money equation used to calculate this value is illustrated in Figure 2–7 and is represented as follows:

Present value (PV) of an annuity stream (PMT) received in the future:

$$PV = PMT \sum_{j=1}^{t} [1/(1 + r)]^j = PMT(PVIFA_{r,t}) \quad (3)$$

where

PMT = Periodic annuity payment received during an investment horizon
$PVIFA_{r,t}$ = Present value interest factor of an annuity
$= \sum_{j=1}^{t} [(1/(1 + r)]^j$

$\sum_{j=1}^{t}$ = Summation sign for addition of all terms from $j = 1$ to $j = t$

EXAMPLE 2–4 Calculation of Present Value of an Annuity

You have been offered a bond that will pay you $10,000 on the last day of every year for the next six years in exchange for a fixed payment today. We illustrate this investment in Figure 2–7. If the appropriate annual interest rate on the investment is 8 percent, the present value of this investment is computed as follows:

$$\begin{aligned} PV &= PMT\,(PVIFA_{r,t}) \\ &= \$10{,}000\,(PVIFA_{8\%,6}) \\ &= \$10{,}000\,(4.622880) = \$46{,}228.80 \end{aligned}$$

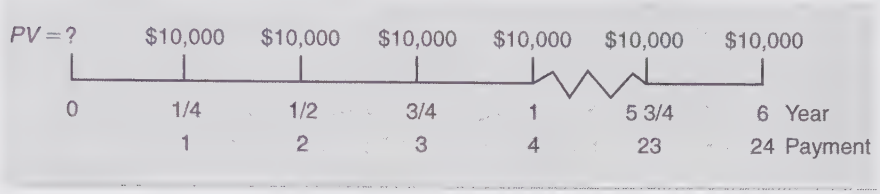
If the investment pays you $10,000 on the last day of every quarter for the next six years (i.e., $r = 8\%/4 = 2\%$ and $t = 6 \times 4 = 24$; see Figure 2–8), the present value of the annuity becomes:

$$\begin{aligned} PV &= \$10{,}000\,(PVIFA_{2\%,24}) \\ &= \$10{,}000\,(18.913926) = \$189{,}139.26 \end{aligned}$$

If the annuity is paid on the first day of each quarter, an extra interest payment would be received for each $10,000 payment. Thus, the time value of money equation for the present value of an annuity becomes:

$$PV = PMT\,(PVIFA_{r,t})(1 + r)$$

FIGURE 2–8 Present Value of $10,000 Received on the Last Day of Each Quarter for Six Years (i.e., $t = 6 \times 4 = 24$)



The present value of this investment becomes:

$$PV = \$10{,}000\ (PVIFA_{2\%,24})(1 + .02)$$
$$= \$10{,}000\ (18.913926)(1.02) = \$192{,}922.04$$

Future Value of an Annuity. The future value of an annuity equation converts a series of equal cash flows received at equal intervals throughout the investment horizon into an equivalent future amount at the end of the investment horizon. The equation used to calculate this value is illustrated by the example in Figure 2–9 and is represented as follows:

Future value of an annuity payment stream received over an investment horizon:

$$FV_t = PMT \sum_{j=0}^{t-1} (1 + r)^j = PMT\ (FVIFA_{r,t}) \tag{4}$$

where

$FVIFA_{r,t}$ = Future value interest factor of an annuity payment stream[5]

$$= \sum_{j=0}^{t-1} (1 + r)^j$$

EXAMPLE 2–5 Calculation of the Future Value of an Annuity

You plan to invest $10,000 on the last day of every year for the next six years (as in Figure 2–9). If the interest rate on the investment is 8 percent, the future value of your investment in six years is computed as follows:

$$FV = \$10{,}000\ (FVIFA_{8\%,6})$$
$$= \$10{,}000\ (7.335929) = \$73{,}359.29$$

If the investment pays you $10,000 on the last day of every quarter for the next six years (i.e., $r = 8\%/4 = 2\%$ and $t = 6 \times 4 = 24$), the future value of the annuity becomes:

$$FV = \$10{,}000\ (FVIFA_{2\%,24})$$
$$= \$10{,}000\ (30.421862) = \$304{,}218.62$$

If the annuity is paid on the first day of each quarter, an extra interest payment would be earned on each $10,000 investment. Thus, the time value of money equation for the future value of an annuity becomes:

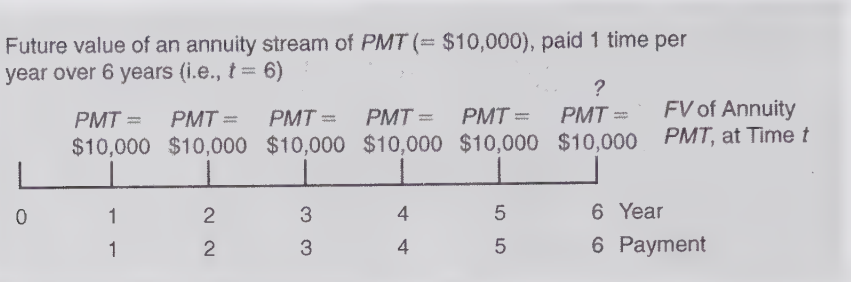
$$FV = PMT(FVIFA_{r,t})(1 + r)$$

Thus, the future value of this investment becomes:

$$FV = \$10{,}000\ (FVIFA_{2\%,24})(1 + .02)$$
$$= \$10{,}000\ (31.030300) = \$310{,}303.00$$

5. Note that the last annuity payment occurs on the last day of the investment horizon. Thus, it earns no interest (i.e., the future value interest factor takes a power of zero). Similarly, the first annuity payment earns only five years of interest. Thus, the future value interest factor takes a power of five. Accordingly, in the future value interest factor of annuity term, j runs from 0 to $t - 1$, or, in this example, $(6 - 1 =) 5$. In Example 2–4, note that the first annuity payment earns one year of interest. Thus, the present value interest factor term takes a power of one. Likewise, the last annuity payment earns six years of interest. Thus, the present value interest factor takes a power of six. Accordingly, in the present value interest factor of annuity term, j runs from 1 to t, or, in this example, 6.

FIGURE 2–9 **Future Value of an Annuity**
(invested at the rate of r per period)



Effective Annual Return

effective or equivalent annual return
Rate earned over a 12-month period taking the compounding of interest into account.

The annual interest rate, i, used in the time value of money equations in Examples 2–2 through 2–5, is the simple (nominal or 12-month) interest rate on the securities. However, if interest is paid or compounded more than once per year, the true annual rate earned or paid will differ from the simple annual rate. The **effective** or **equivalent annual return** (*EAR*) is the return earned or paid over a 12-month period taking any within-year compounding of interest into account. Specifically, the *EAR* can be written as follows:

$$EAR = (1 + r)^c - 1 \quad (5)$$

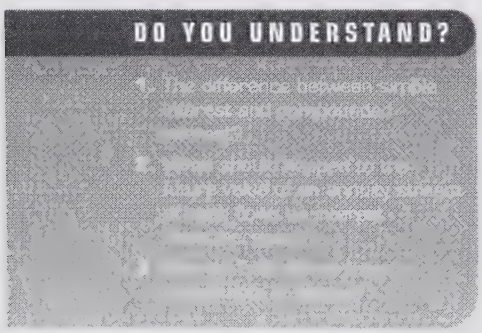
where c = number of compounding periods per year.

In Example 2–2, the *EAR* on the 16 percent simple return compounded semiannually (i.e., $r = 16\%/2 = 8\%$ and $c = 2$) is computed as:

$$EAR = (1 + .08)^2 - 1 = 16.64\%$$

and in Example 2–4 the *EAR* on the 8 percent simple return compounded quarterly (i.e., $r = 8\%/4 = 2\%$ and $c = 4$) is computed as:

$$EAR = (1 + .02)^4 - 1 = 8.24\%$$



Thus, for each dollar invested at the beginning of the year, at 16 percent (compounded semiannually) and 8 percent (compounded quarterly) respectively, you would have earned $0.1664 and $0.0824 at the end of the year. Accordingly, the *EAR* provides a more accurate measure of annual returns in time value of money calculations.

LOANABLE FUNDS THEORY

loanable funds theory
A theory of interest rate determination that views equilibrium interest rates in financial markets as a result of the supply and demand for loanable funds.

So far we have shown the technical details of how interest rates play a part in the determination of the value of financial instruments. Given the impact a change in interest rates has on security values, financial institution and other managers spend much time and effort trying to identify the factors that determine the level of interest rates at any moment in time, as well as what causes interest rate movements over time. One model that is commonly used to explain interest rates and interest rate movements is **loanable funds theory.** The loanable funds theory of interest rate determination views the level of interest rates in financial markets as resulting from factors that affect the supply and demand for loanable funds. This is similar to the way that the prices for goods and services in general are viewed as being the result of the forces of supply and demand for those goods and services. The *supply of loanable funds* is a term commonly used to describe funds provided to the financial markets by net suppliers of funds. The *demand for loanable funds* is a term used to describe the total net demand for funds by fund users. The loanable funds framework categorizes financial market participants—suppliers and demanders of funds—as consumers, businesses, governments,

TABLE 2–1 Factors that Affect the Supply of and Demand for Loanable Funds for a Financial Security

Panel A: The Supply of Funds

Factor	Change in Factor	Impact on Supply of Funds	Impact on Equilibrium Interest Rate
Interest rate	Increase	Movement up along the supply curve	Increase
	Decrease	Movement down along the supply curve	Decrease
Total wealth	Increase	Shift supply curve down and to the right	Decrease
	Decrease	Shift supply curve up and to the left	Increase
Risk of financial security	Increase	Shift supply curve up and to the left	Increase
	Decrease	Shift supply curve down and to the right	Decrease
Near-term spending needs	Increase	Shift supply curve up and to the left	Increase
	Decrease	Shift supply curve down and to the right	Decrease
Monetary expansion	Increase	Shift supply curve down and to the right	Decrease
	Decrease	Shift supply curve up and to the left	Increase
Economic conditions	Increase	Shift supply curve down and to the right	Decrease
	Decrease	Shift supply curve up and to the left	Increase

Panel B: The Demand for Funds

Factor	Change in Factor	Impact on Demand for Funds	Impact on Equilibrium Interest Rate
Interest rate	Increase	Movement up along the demand curve	Increase
	Decrease	Movement down along the demand curve	Decrease
Utility derived from asset purchased with borrowed funds	Increase	Shift demand curve up and to the right	Increase
	Decrease	Shift demand curve down and to the left	Decrease
Restrictiveness of nonprice conditions	Increase	Shift demand curve down and to the left	Decrease
	Decrease	Shift demand curve up and to the right	Increase
Economic conditions	Increase	Shift demand curve up and to the right	Increase
	Decrease	Shift demand curve down and to the left	Decrease

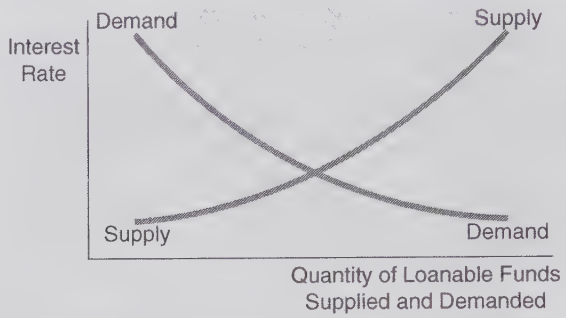
and foreign participants. Table 2–1 summarizes the factors that affect the supply and demand for loanable funds discussed in this section, their impact on the supply and demand for loanable funds for a specific security, and the impact on the market clearing (or equilibrium) interest rates holding all other factors constant.

2 Supply of Loanable Funds

In general, the quantity of loanable funds supplied increases as interest rates rise. Figure 2–10 illustrates the supply curve for loanable funds. Other factors held constant, more funds are supplied as interest rates increase (the reward for supplying funds is higher). Table 2–2 presents data on the supply of loanable funds from the various groups of market participants from U.S. flow of funds data as of March 2004.

The household sector (consumer sector) is the largest supplier of loanable funds in the United States—$34,860.7 billion in 2004. Households supply funds when they have excess income or want to reallocate their asset portfolio holdings. For example, during times of high economic growth, households may replace part of their cash holdings with earning assets

FIGURE 2–10 Supply of and Demand for Loanable Funds



(i.e., by supplying loanable funds in exchange for holding securities). As the total wealth of a consumer increases, the total supply of loanable funds from that consumer will also generally increase. Households determine their supply of loanable funds not only on the basis of the general level of interest rates and their total wealth, but also on the risk of securities investments. The greater the perceived risk of securities investments, the less households are willing to invest at each interest rate. Further, the supply of loanable funds from households also depends on their immediate spending needs. For example, near-term educational or medical expenditures will reduce the supply of funds from a given household.

Higher interest rates will also result in higher supplies of funds from the U.S. business sector ($12,679.2 billion from nonfinancial business and $31,547.9 billion from financial business in 2004) which often has excess cash, or working capital, that it can invest for short periods of time in financial assets. In addition to the interest rates on these investments, the expected risk on financial securities and their businesses' future investment needs will affect their overall supply of funds.

Loanable funds are also supplied by some governments ($12,574.5 billion in 2004). For example, some governments (e.g., municipalities) temporarily generate more cash inflows (e.g., through local taxes) than they have budgeted to spend. These funds can be loaned out to financial market fund users until needed.

Finally, foreign investors increasingly view U.S. financial markets as alternatives to their domestic financial markets ($8,426.7 billion of funds supplied to the U.S. financial markets in 2004). When interest rates are higher on U.S. financial securities than they are on comparable securities in their home countries, foreign investors increase their supply of funds to U.S. markets. Indeed the high savings rates of foreign households (such as Japanese households) has resulted in foreign market participants being major suppliers of funds to U.S. financial markets

TABLE 2–2 Funds Supplied and Demanded by Various Groups
(in billions of dollars)

	Funds Supplied	Funds Demanded	Net Funds Supplied (Funds Supplied − Funds Demanded)
Households	$34,860.7	$15,197.4	$19,663.3
Business—nonfinancial	12,679.2	30,779.2	−18,100.0
Business—financial	31,547.9	45,061.3	−13,513.4
Government units	12,574.5	6,695.2	5,879.3
Foreign participants	8,426.7	2,355.9	6,070.8

Source: Federal Reserve Board Web site, "Flow of Fund Accounts," June 10, 2004. **www.federalreserve.gov**

in recent years. Similar to domestic suppliers of loanable funds, foreigners assess not only the interest rate offered on financial securities, but also their total wealth, the risk on the security, and their future expenditure needs. Additionally, foreign investors alter their investment decisions as financial conditions in their home countries change relative to the U.S. economy and the exchange rate of their country's currency vis-à-vis the U.S. dollar (see Chapter 8). For example, in the early 2000s, because of the severe financial and economic crisis in Argentina, the government halted payments on its debt as well as debt Argentine companies owed to foreign creditors. The result was a halt in the flow of funds into financial markets in Argentina.

3 Demand for Loanable Funds

In general, the quantity of loanable funds demanded is higher as interest rates fall. Figure 2–10 also illustrates the demand curve for loanable funds. Other factors held constant, more funds are demanded as interest rates decrease (the cost of borrowing funds is lower).

Households (although they are net suppliers of funds) also borrow funds in financial markets ($15,197.4 billion in 2004). The demand for loanable funds by households reflects the demand for financing purchases of homes (with mortgage loans), durable goods (e.g., car loans, appliance loans), and nondurable goods (e.g., education loans, medical loans). Additional nonprice conditions and requirements (discussed below) also affect a household's demand for loanable funds at every level of interest rates.

Businesses demand funds to finance investments in long-term (fixed) assets (e.g., plant and equipment) and for short-term working capital needs (e.g., inventory and accounts receivable) usually by issuing debt and other financial instruments ($30,779.2 billion for nonfinancial businesses and $45,061.3 for financial businesses in 2004). When interest rates are high (i.e., the cost of loanable funds is high), businesses prefer to finance investments with internally generated funds (e.g., retained earnings) rather than through borrowed funds. Further, the greater the number of profitable projects available to businesses, or the better the overall economic conditions, the greater the demand for loanable funds.

Governments also borrow heavily in the markets for loanable funds ($6,695.2 billion in 2004). For example, state and local governments often issue debt instruments to finance temporary imbalances between operating revenues (e.g., taxes) and budgeted expenditures (e.g., road improvements, school construction). Higher interest rates can cause state and local governments to postpone borrowings and thus capital expenditures. Similar to households and businesses, governments' demand for funds varies with general economic conditions. The federal government is also a large borrower partly to finance current budget deficits (expenditures greater than taxes) and partly to finance past deficits. The cumulative sum of past deficits is called the national debt, which in the United States in August 2004 stood at over $7.3 trillion. Thus, the national debt and especially the interest payments on the national debt have to be financed in large part by additional government borrowing. Chapter 4 provides details of how government borrowing and spending impacts interest rates as well as overall economic growth.

www.ustreas.gov

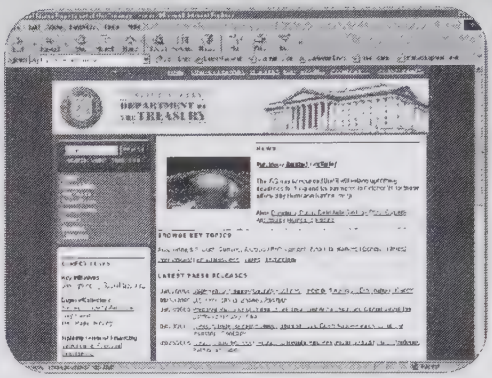
Finally, foreign participants (households, businesses, and governments) also borrow in U.S. financial markets ($2,355.9 billion in 2004). Foreign borrowers look for the cheapest source of dollar funds globally. Most foreign borrowing in U.S. financial markets comes from the business sector. In addition to interest costs, foreign borrowers consider nonprice terms on loanable funds as well as economic conditions in the home country and the general attractiveness of the U.S. dollar relative to their domestic currency (e.g., the euro or the yen). In Chapter 8, we examine how economic growth in domestic versus foreign countries affects foreign exchange rates and foreign investors' demand and supply for funds.

4 Equilibrium Interest Rate

The aggregate supply of loanable funds is the sum of the quantity supplied by the separate fund supplying sectors (e.g., households, business, governments, foreign agents) discussed above. Similarly, the aggregate demand for loanable funds is the sum of the quantity demanded by the separate fund demanding sectors. As illustrated in

SEARCH THE SITE

Go to the United States Treasury and find the latest information available on the size of the U.S. national debt.



Go to the U.S. Treasury Web site at
www.ustreas.gov

Click on "Bureaus"

Click on "Bureau of Public Debt"

Click on "The Public Debt"

Click on "Daily amounts to the penny . . ."

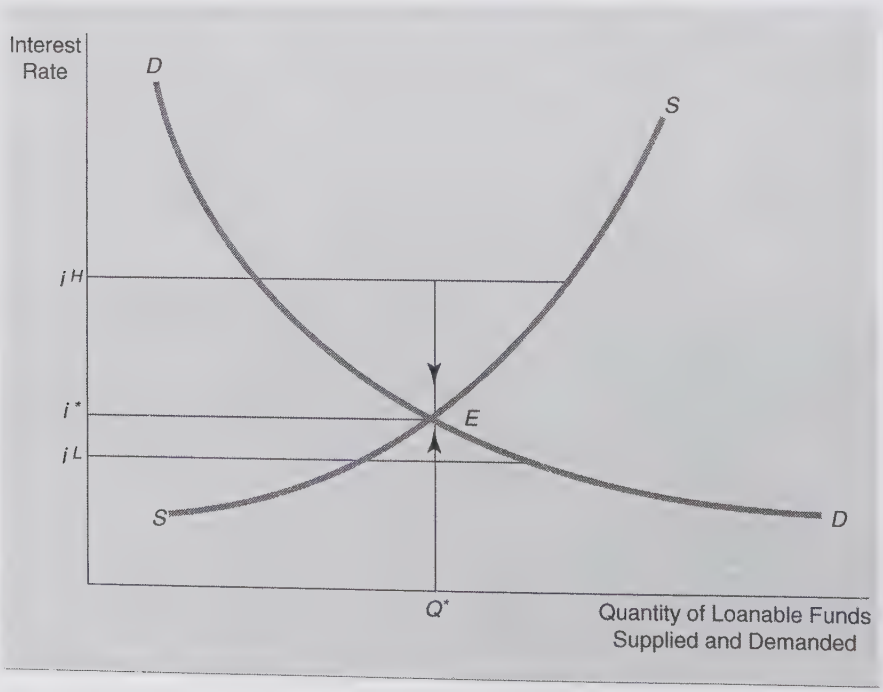
This will bring up the relevant tables. For example, on August 2, 2004, the size of the national debt was $7.312 trillion.

Questions

1. What is the most recents dollar value of the U.S. national debt?
2. Calculate the percentage change in the U.S. notional debt since August 12, 2005.

Figure 2–11, the aggregate quantity of funds supplied is positively related to interest rates, while the aggregate quantity of funds demanded is inversely related to interest rates. As long as competitive forces are allowed to operate freely in a financial system, the interest rate that equates the aggregate quantity of loanable funds supplied with aggregate quantity of loanable funds demanded for a financial security, Q^*, is the equilibrium interest rate for that

FIGURE 2–11 Determination of Equilibrium Interest Rates



security, i^*, point E in Figure 2–11. For example, whenever the rate of interest is set higher than the equilibrium rate, such as i^H, the financial system has a surplus of loanable funds. As a result, some suppliers of funds will lower the interest rate at which they are willing to lend and the demanders of funds will absorb the loanable funds surplus. In contrast, when the rate of interest is lower than the equilibrium interest rate, such as i^L, there is a shortage of loanable funds in the financial system. Some borrowers will be unable to obtain the funds they need at current rates. As a result, interest rates will increase, causing more suppliers of loanable funds to enter the market and some demanders of funds to leave the market. These competitive forces will cause the quantity of funds supplied to increase and the quantity of funds demanded to decrease until a shortage of funds no longer exists.

5 Factors that Cause the Supply and Demand Curves for Loanable Funds to Shift

While we have alluded to the fundamental factors that cause the supply and demand curves for loanable funds to shift, in this section we formally summarize these factors. We then examine how shifts in the supply and demand curves for loanable funds determine the equilibrium interest rate on a specific financial instrument. A shift in the supply or demand curve occurs when the quantity of a financial security supplied or demanded changes at every given interest rate in response to a change in another factor besides the interest rate. In either case, a change in the supply or demand curve for loanable funds causes interest rates to move.

Supply of Funds. We have already described the positive relation between interest rates and the supply of loanable funds along the loanable funds supply curve. Factors that cause the supply curve of loanable funds to shift, at any given interest rate, include the wealth of fund suppliers, the risk of the financial security, future spending needs, monetary policy objectives, and economic conditions.

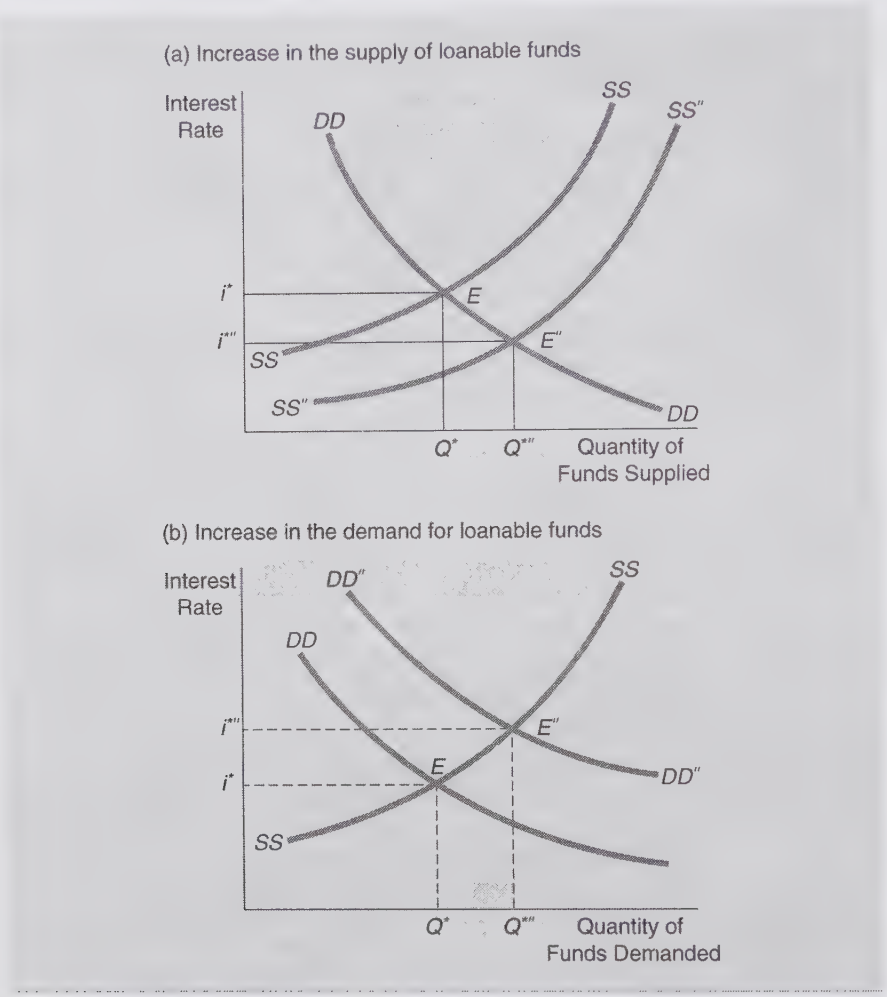
Wealth. As the total wealth of financial market participants (households, business, etc.) increases, the absolute dollar value available for investment purposes increases. Accordingly, at every interest rate, the supply of loanable funds increases, or the supply curve shifts down and to the right. For example, as the U.S. economy grew in the 1990s, total wealth of U.S. investors increased as well. Consequently, the supply of funds available for investing (e.g., in stock and bond markets) increased at every available interest rate. We show this shift (increase) in the supply curve in Figure 2–12 (a) as a move from SS to SS''. The shift in the supply curve creates a disequilibrium between demand and supply. To eliminate the imbalance or disequilibrium in this financial market, the equilibrium interest rate falls, from i^* to $i^{*''}$, which is associated with an increase in the quantity of funds loaned between fund suppliers and fund demanders, from Q^* to $Q^{*''}$.

Conversely, as the total wealth of financial market participants decreases, the absolute dollar value available for investment purposes decreases. Accordingly, at every interest rate, the supply of loanable funds decreases, or the supply curve shifts up and to the left. The decrease in the supply of funds due to a decrease in the total wealth of market participants results in an increase in the equilibrium interest rate and a decrease in the equilibrium quantity of funds loaned (traded).

Risk. As the risk of a financial security decreases (e.g., the probability that the issuer of the security will default on promised repayments of the funds borrowed), it becomes more attractive to suppliers of funds. At every interest rate, the supply of loanable funds increases, or the supply curve shifts down and to the right, from SS to SS'' in Figure 2–12(a). Holding all other factors constant, the increase in the supply of funds, due to a decrease in the risk of the financial security, results in a decrease in the equilibrium interest rate, from i^* to $i^{*''}$, and an increase in the equilibrium quantity of funds traded, from Q^* to $Q^{*''}$.

Conversely, as the risk of a financial security increases, it becomes less attractive to suppliers of funds. Accordingly, at every interest rate, the supply of loanable funds decreases, or

FIGURE 2–12 The Effect on Interest Rates from a Shift in the Demand Curve for or Supply Curve of Loanable Funds



the supply curve shifts up and to the left. Holding all other factors constant, the decrease in the supply of funds due to an increase in the financial security's risk results in an increase in the equilibrium interest rate and a decrease in the equilibrium quantity of funds loaned (or traded).

Near-Term Spending Needs. When financial market participants have few near-term spending needs, the absolute dollar value of funds available to invest increases. For example, when a family's son or daughter moves out of the family home to live on his or her own, current spending needs of the family decrease and the supply of available funds (for investing) increases. At every interest rate, the supply of loanable funds increases, or the supply curve shifts down and to the right. The financial market, holding all other factors constant, reacts to this increased supply of funds by decreasing the equilibrium interest rate and increasing the equilibrium quantity of funds traded.

Conversely, when financial market participants have increased near-term spending needs, the absolute dollar value of funds available to invest decreases. At every interest rate, the supply of loanable funds decreases, or the supply curve shifts up and to the left. The shift in the supply curve creates a disequilibrium in this financial market that results in an increase in the equilibrium interest rate and a decrease in the equilibrium quantity of funds loaned (or traded).

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Monetary Expansion. One method used by the Federal Reserve to implement monetary policy is to alter the availability of funds, the growth in the money supply, and thus the rate of economic expansion of the economy (we explain this process in detail in Chapter 4). When monetary policy objectives are to allow the economy to expand, the Federal Reserve increases the supply of funds available in the financial markets. At every interest rate, the supply of loanable funds increases, the supply curve shifts down and to the right, and the equilibrium interest rate falls, while the equilibrium quantity of funds traded increases.

Conversely, when monetary policy objectives are to restrict the rate of economic expansion (and thus inflation), the Federal Reserve decreases the supply of funds available in the financial markets. At every interest rate, the supply of loanable funds decreases, the supply curve shifts up and to the left, and the equilibrium interest rate rises, while the equilibrium quantity of funds loaned or traded decreases.

Economic Conditions. Finally, as the underlying economic conditions themselves (e.g., the inflation rate, unemployment rate, economic growth) improve in a country relative to other countries, the flow of funds to that country increases. This reflects the lower risk (country or sovereign risk) that the country, in the guise of its government, will default on its obligation to repay funds borrowed. For example, the severe economic crisis in Argentina in the early 2000s resulted in a decrease in the supply of funds to that country. An increased inflow of foreign funds to U.S. financial markets increases the supply of loanable funds at every interest rate and the supply curve shifts down and to the right. Accordingly, the equilibrium interest rate fails and the equilibrium quantity of funds loaned or traded increases.

Conversely, when economic conditions in foreign countries improve, domestic and foreign investors take their funds out of domestic financial markets (e.g., the United States) and invest abroad. Thus, the supply of funds available in the financial markets decreases and the equilibrium interest rate rises, while the equilibrium quantity of funds traded decreases.

Demand for Funds. We explained above that the quantity of loanable funds demanded is negatively related to interest rates. Factors that cause the demand curve for loanable funds to shift include the utility derived from assets purchased with borrowed funds, the restrictiveness of nonprice conditions on borrowing, and economic conditions.

Utility Derived from Assets Purchased with Borrowed Funds. As the utility (i.e., satisfaction or pleasure) derived from an asset purchased with borrowed funds increases, the willingness of market participants (households, business, etc.) to borrow increases and the absolute dollar value borrowed increases. Accordingly, at every interest rate, the demand for loanable funds increases, or the demand curve shifts up and to the right. For example, suppose a change in jobs takes an individual from Arizona to Minnesota. The individual currently has a convertible automobile. Given the move to Minnesota, the individual's utility from the convertible decreases, while it would increase for a car with heated seats. Thus, with a potential increased utility from the purchase of a new car, the individual's demand for funds in the form of an auto loan increases. We show this shift (increase) in the demand curve in Figure 2–12(b) as a move from DD to DD''. The shift in the demand curve creates a disequilibrium in this financial market. Holding all other factors constant, the increase in the demand for funds due to an increase in the utility from the purchased asset results in an increase in the equilibrium interest rate, from i^* to $i^{*''}$, and an increase in the equilibrium quantity of funds traded, from Q^* to $Q^{*''}$.

Conversely, as the utility derived from an asset purchased with borrowed funds decreases, the willingness of market participants (households, businesses, etc.) to borrow decreases and the absolute dollar amount borrowed decreases. Accordingly, at every interest rate, the demand for loanable funds decreases, or the demand curve shifts down and to the left. The shift in the demand curve again creates a disequilibrium in this financial market. As competitive forces adjust, and holding all other factors constant, the decrease in the demand for funds due to a decrease in the utility from the purchased asset results in a decrease in the equilibrium interest rate and a decrease in the equilibrium quantity of funds loaned or traded.

Restrictiveness on Nonprice Conditions on Borrowed Funds. As the nonprice restrictions put on borrowers as a condition of borrowing decrease, the willingness of market participants to borrow increases and the absolute dollar value borrowed increases. Such nonprice conditions may include fees, collateral, requirements or restrictions on the use of funds (so-called restrictive covenants, see Chapter 6). The lack of such restrictions makes the loan more desirable to the user of funds. Accordingly, at every interest rate, the demand for loanable funds increases, or the demand curve shifts up and to the right, from DD to DD''. As competitive forces adjust, and holding all other factors constant, the increase in the demand for funds due to a decrease in the restrictive conditions on the borrowed funds results in an increase in the equilibrium interest rate, from i^* to $i^{*''}$, and an increase in the equilibrium quantity of funds traded, from Q^* to $QQ^{*''}$.

Conversely, as the nonprice restrictions put on borrowers as a condition of borrowing increase, market participants' willingness to borrow decreases and the absolute dollar value borrowed decreases. Accordingly, the demand curve shifts down and to the left. The shift in the demand curve results in a decrease in the equilibrium interest rate and a decrease in the equilibrium quantity of funds traded.

Economic Conditions. When the domestic economy experiences a period of growth, such as that in the United States in the 1990s, market participants are willing to borrow more heavily. For example, state and local governments would be more likely to repair and improve decaying infrastructure when the local economy is strong. Accordingly, the demand curve for funds shifts up and to the right. Holding all other factors constant, the increase in the demand for funds due to economic growth results in an increase in the equilibrium interest rate and an increase in the equilibrium quantity of funds traded.

DO YOU UNDERSTAND?

1. [illegible]

Conversely, when domestic economic growth is stagnant, market participants reduce their demand for funds. Accordingly, the demand curve shifts down and to the left, resulting in a decrease in the equilibrium interest rate and a decrease in the equilibrium quantity of funds traded.

6 MOVEMENT OF INTEREST RATES OVER TIME

DO YOU UNDERSTAND?

1. What will happen to the equilibrium interest rate when the demand for loanable funds increases?

As discussed in the previous section of this chapter, the loanable funds theory of interest rates is based on the supply and demand for loanable funds as functions of interest rates. The equilibrium interest rate (point E in Figure 2–11) is only a temporary equilibrium. Changes in underlying factors that determine the demand and supply of loanable funds can cause continuous shifts in the supply and/or demand curves for loanable funds. Market forces will react to the resulting disequilibrium with a change in the equilibrium interest rate and quantity of funds traded in that market. Refer again to Figure 2–12(a), which shows the effects of an *increase in the supply curve* for loanable funds, from SS to SS'' (and the resulting *decrease in the equilibrium interest rate,* from i^* to $i^{*''}$), while Figure 2–12(b) shows the effects of an *increase in the demand curve* for loanable funds, from DD to DD'' (and the resulting *increase in the equilibrium interest rate,* from i^* to $i^{*''}$).

7 DETERMINANTS OF INTEREST RATES FOR INDIVIDUAL SECURITIES

So far we have looked at the general determination of equilibrium (nominal) interest rates for financial securities in the context of the loanable demand and supply theory of the flow of funds. In this section, we examine the specific factors that affect differences in interest rates across the range of real-world financial markets (i.e., differences among interest rates on individual securities, given the underlying level of interest

TABLE 2–3 Factors Affecting Nominal Interest Rates

Inflation—The continual increase in the price level of a basket of goods and services.
Real Interest Rate—nominal interest rate that would exist on a security if no inflation were expected.
Default Risk—risk that a security issuer will default on the security by missing an interest or principal payment.
Liquidity Risk—risk that a security cannot be sold at a predictable price with low transaction costs at short notice.
Special Provisions—provisions (e.g., taxability, convertibility, and callability) that impact the security holder beneficially or adversely and as such are reflected in the interest rates on securities that contain such provisions.
Time to Maturity—length of time a security has until maturity.

rates determined by the demand and supply of loanable funds). These factors include inflation, the "real" interest rate, default risk, liquidity risk, special provisions regarding the use of funds raised by a security's issuance, and the term to maturity of the security. We examine each of these factors in this section and summarize them in Table 2–3.

Inflation

inflation

The continual increase in the price level of a basket of goods and services.

The first factor to affect interest rates is the *actual or expected inflation rate* in the economy. Specifically, the higher the level of actual or expected inflation, the higher will be the level of interest rates. The intuition behind the positive relationship between interest rates and inflation rates is that an investor who buys a financial asset must earn a higher interest rate when inflation increases to compensate for the increased cost of forgoing consumption of real goods and services today and buying these more highly priced goods and services in the future. In other words, the higher the rate of inflation, the more expensive the same basket of goods and services will be in the future. **Inflation** of the general price index of goods and services (IP) is defined as the (percentage) increase in the price of a standardized basket of goods and services over a given period of time. In the United States, inflation is measured using indexes such as the consumer price index (CPI) and the producer price index (PPI). For example, the annual inflation rate using the CPI index between years t and $t + 1$ would be equal to:

$$\text{Inflation } (IP) = \frac{CPI_{t+1} - CPI_t}{CPI_t} \times \frac{100}{1}$$

Real Interest Rates

real interest rate

The interest rate that would exist on a default free security if no inflation were expected.

A **real interest rate** is the interest rate that would exist on a security if no inflation were expected over the holding period (e.g., a year) of a security. As such, it measures society's relative time preference for consuming today rather than tomorrow. The higher society's preference to consume today (i.e., the higher its time value of money or rate of time preference), the higher the real interest rate (RIR) will be.

Fisher Effect. The relationship among real interest rates (RIR), expected inflation [Expected (IP)], described above, and nominal interest rates (i) is often referred to as the Fisher effect, named for the economist Irving Fisher, who identified these relationships early last century. The Fisher effect theorizes that nominal interest rates observed in financial markets must compensate investors for (1) any reduced purchasing power on funds lent (or principal lent) due to inflationary price changes and (2) an additional premium above the expected rate of inflation for forgoing present consumption (which reflects the real interest rate discussed above).

$$i = \text{Expected } (IP) + RIR \qquad (6)$$

Thus, the nominal interest rate will be equal to the real interest rate only when market participants expect inflation to be zero—Expected $(IP) = 0$. Similarly, nominal interest rates will be equal to the expected inflation rate only when real interest rates are zero. Note that we can rearrange the nominal interest rate equation to show the determinants of the real interest rate:

Often the Fisher effect formula is written as:

$$i = RIR + \text{Expected } (IP) + [RIR \times \text{Expected } (IP)]$$

where $RIR \times$ Expected (IP) is the inflation premium for the loss of purchasing power on the promised nominal interest rate payments due to inflation. For small values of RIR and Expected (IP) this term is negligible. The approximation formula in Equation 7 assumes these values are small.

$$RIR = i - \text{Expected } (IP) \tag{7}$$

EXAMPLE 2–6 Calculations of Real Interest Rates

The one-year Treasury bill rate in 2001 averaged 3.49 percent and inflation (measured by the consumer price index) for the year was 1.60 percent. If investors had expected the same inflation rate as that actually realized (i.e., 1.60 percent), then according to the Fisher effect the real interest rate for 2001 was:

$$3.49\% - 1.60\% = 1.89\%$$

The one-year T-bill rate in 2003 was 1.24 percent, while the CPI for the year was 1.90 percent, which implies a real interest rate of −0.66 percent, that is, the real interest rate was actually negative.

stats.bls.gov/cpi/home.htm

Figure 2–13 shows the nominal interest rate (one-year T-bill rate) versus the change in the CPI from 1962 through 2004. Because the expected inflation rate is difficult to estimate accurately, the real interest rate can be difficult to measure accurately as well, since investors' expectations are not always realized. A 2004 study by Ibbotson Associates found that inflation over the period 1926 to 2003 averaged 3.03 percent per year, from 1926 to 1965 inflation averaged 1.56 percent per year, for the last 20 years it averaged 3.07 percent, and for the last 10 years inflation averaged 2.45 percent. As a result, Treasury bills provided a negative real rate in every holding period except for the last 10 and 20 years. Specifically, the real rate on Treasury bills over the period 1926 to 2003 averaged –1.02 percent per year, from 1926 to 1965 averaged –1.49 percent per year, for the last 20 years it averaged 0.15 percent, and for the last 10 years it averaged 0.15 percent.[6]

Default or Credit Risk

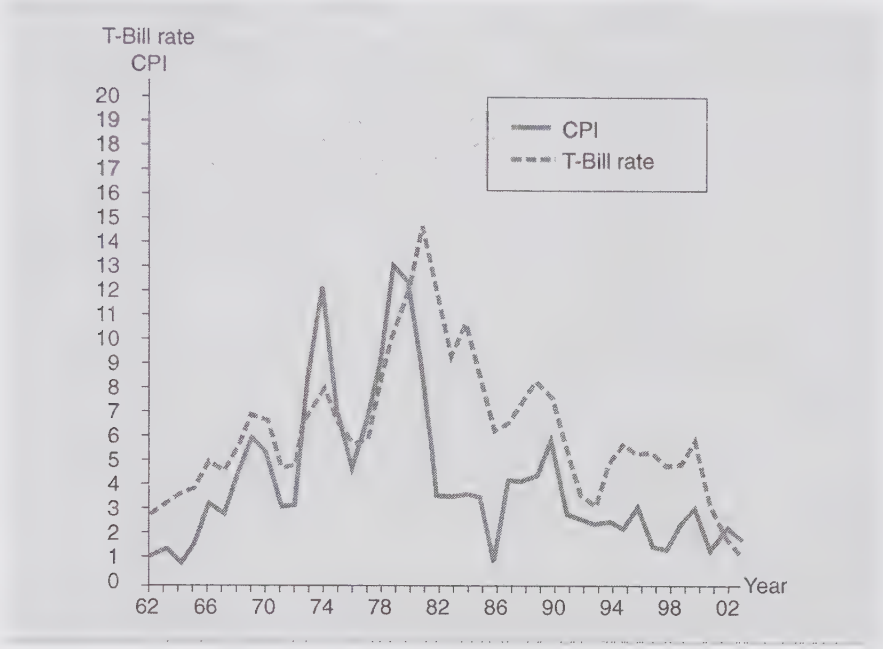
default risk

The risk that a security issuer will default on that security by being late on or missing an interest or principal payment.

Default risk is the risk that a security issuer will default on making its promised interest and principal payments to the buyer of a security. The higher the default risk, the higher the interest rate that will be demanded by the buyer of the security to compensate him or her for this default (or credit) risk exposure. Not all securities exhibit default risk. For example, U.S. Treasury securities are regarded as having no default risk since they are issued by the U.S. government, and the probability of the U.S. government defaulting on its debt payments is practically zero given its taxation powers and its ability to print currency. Some borrowers, however, such as corporations or individuals, have less predictable cash flows (and no taxation powers), and therefore investors charge them an interest rate risk premium reflecting their perceived probability of default and the potential recovery of the amount loaned. The difference between a quoted interest rate on a security (security j) and a Treasury security

6. Ibbotson Associates, *Stocks, Bonds, Bills, and Inflation 2004 Yearbook* (Chicago: Ibbotson Associates, 2004).

FIGURE 2–13 Nominal Interest Rates versus Inflation



Source: Federal Reserve Board Web site and U.S. Department of Labor Web site, August 2004.
www.federalreserve.gov and **stats.bls.gov/cpi/home.htm**

with similar maturity, liquidity, tax, and other features (such as callability or convertibility) is called a *default* or *credit risk premium* (DRP_j). That is:

$$DRP_j = i_{jt} - i_{Tt} \tag{8}$$

where

www.moodys.com

i_{jt} = interest rate on a security issued by a non-Treasury issuer (issuer j) of maturity m at time t

www.standardandpoors.com

i_{Tt} = interest rate on a security issued by the U.S. Treasury of maturity m at time t

The default risk on many corporate bonds is evaluated and categorized by various bond rating agencies such as Moody's and Standard & Poor's. (We discuss these ratings in more detail in Chapter 6.) For example, in December 2003, the 10-year Treasury interest rate, or yield, was 4.01 percent. On Aaa-rated and Baa-rated corporate debt interest rates were 5.66 percent and 6.76 percent, respectively. Thus, the average default risk premiums on the Aaa-rated and Baa-rated corporate debt were:

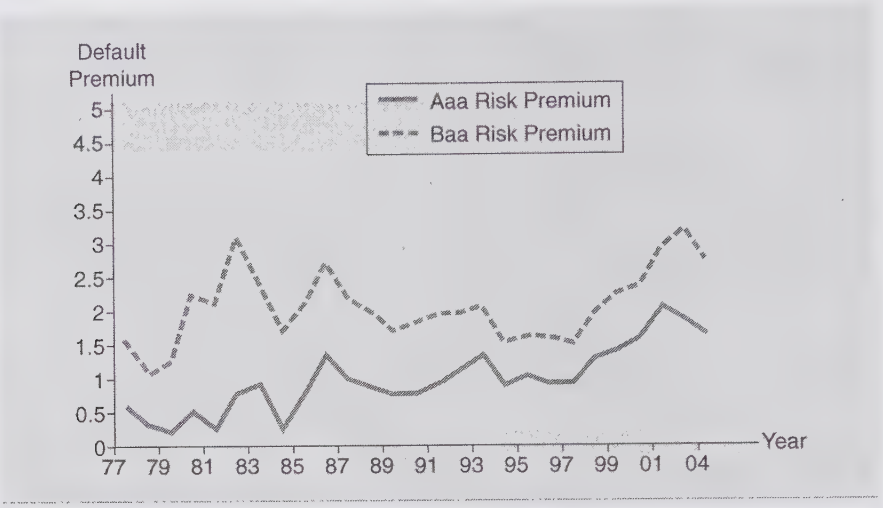
$$DRP_{Aaa} = 5.66\% - 4.01\% = 1.65\%$$
$$DRP_{Baa} = 6.76\% - 4.01\% = 2.75\%$$

Figure 2–14 presents these risk premiums from 1977 through 2004. Notice from this figure and Figure 2–13 that default risk premiums tend to increase when the economy is contracting and decrease when the economy is expanding. For example, from 1981 to 1982 real interest rates (T-bills—CPI in Figure 2–13) increased from 5.90 percent to 8.47 percent. Over the same period, default risk premiums on Aaa-rated bonds increased from 0.25 percent to 0.78 percent and on Baa-rated bonds from 2.12 percent to 3.10 percent.

Liquidity Risk

A highly liquid asset is one that can be sold at a predictable price with low transaction costs and thus can be converted into its full market value at short notice. The interest rate

FIGURE 2–14 Default Risk Premium on Corporate Bonds



Source: Federal Reserve Board Web site, August 2004. **www.federalreserve.gov**

liquidity risk

The risk that a security can be sold at a predictable price with low transaction costs on short notice.

on a security reflects its relative liquidity, with highly liquid assets carrying the lowest interest rates (all other characteristics remaining the same). Likewise, if a security is illiquid, investors add a **liquidity risk** premium (LRP) to the interest rate on the security. In the United States, liquid markets exist for most government securities and the stocks and some bonds issued by large corporations. Many bonds, however, do not trade on a regular basis or on organized exchanges such as the NYSE. As a result, if investors wish to sell these bonds quickly, they may get a lower price than they could have received if they had waited to sell the bonds. Consequently, investors demand a liquidity premium on top of all other premiums to compensate for the bond's lack of liquidity and the potential price discount from selling it early.

A different type of liquidity risk premium may also exist (see below) if investors dislike long-term securities because their prices (present values) are more sensitive to interest rate changes than short-term securities (see Chapter 3). In this case, a higher liquidity risk premium may be added to a security with a longer maturity simply because of its greater exposure to price risk (loss of capital value) on a security as interest rates change.

Special Provisions or Covenants

Numerous special provisions or covenants that may be written into the contracts underlying the issuance of a security also affect the interest rates on different securities (see Chapter 6). Some of these special provisions include the security's taxability, convertibility, and callability.

For example, for investors, interest payments on municipal securities are free of federal, state, and local taxes. Thus, the interest rate demanded by a municipal bond holder is smaller than that on a comparable taxable bond—for example, a Treasury bond, which is taxable at the federal level but not at the state or local (city) levels, or a corporate bond, whose interest payments are taxable at the state and local levels as well as federal levels.

A convertible (special) feature of a security offers the holder the opportunity to exchange one security for another type of the issuer's security at a preset price. Because of the value of this conversion option, the convertible security holder requires a lower interest rate than a comparable nonconvertible security holder (all else equal). In general, special provisions that provide benefits to the security holder (e.g., tax-free status and convertibility) are associated with lower interest rates, and special provisions that provide benefits to the security issuer (e.g., callability, by which an issuer has the option to retire—call—a security prior to maturity at a preset price) are associated with higher interest rates.

Term to Maturity

term structure of interest rates

A comparison of market yields on securities, assuming all characteristics except maturity are the same.

Interest rates are also related to the term to maturity of a security.[7] This relationship is often called the **term structure of interest rates** or the yield curve. The term structure of interest rates compares the interest rates on securities, assuming that all characteristics (i.e., default risk, liquidity risk) *except maturity* are the same. The change in required interest rates as the maturity of a security changes is called the maturity premium (MP). The MP, or the difference between the required yield on long- and short-term securities of the same characteristics except maturity can be positive, negative, or zero. The interest or

FIGURE 2–15A Common Shapes for Yield Curves on Treasury Securities

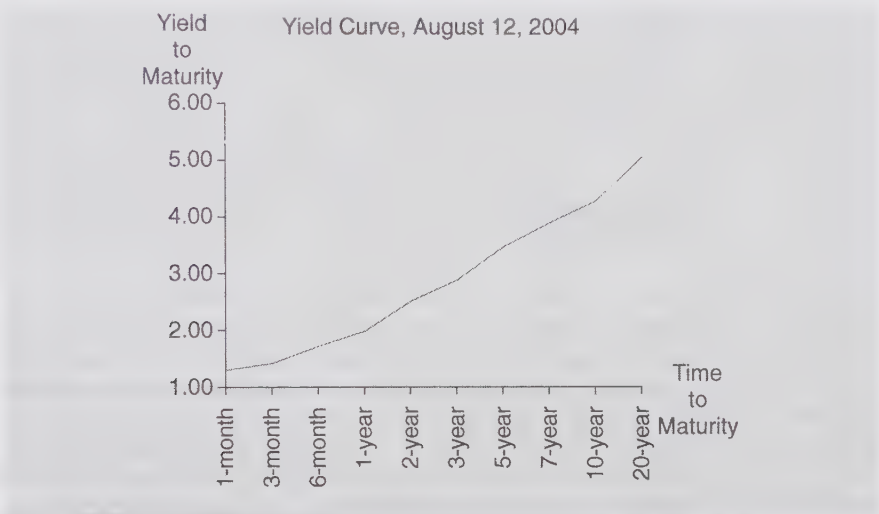
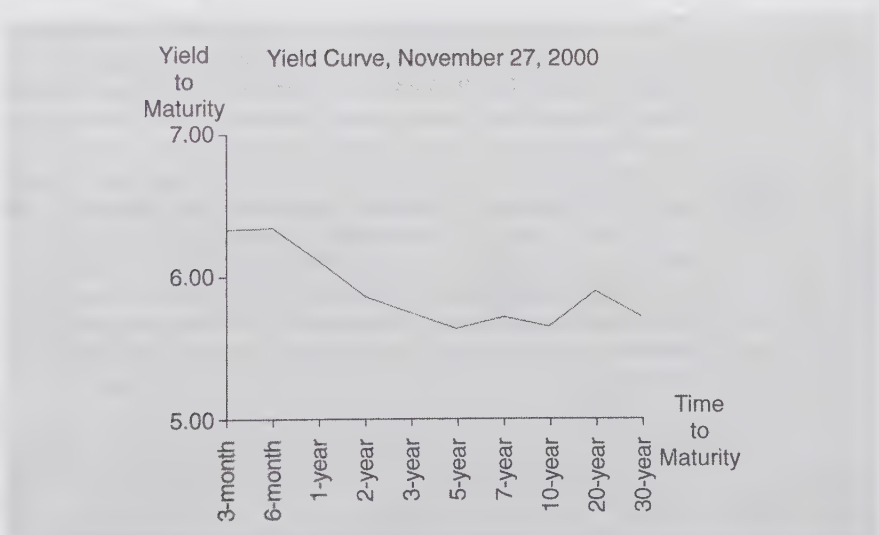


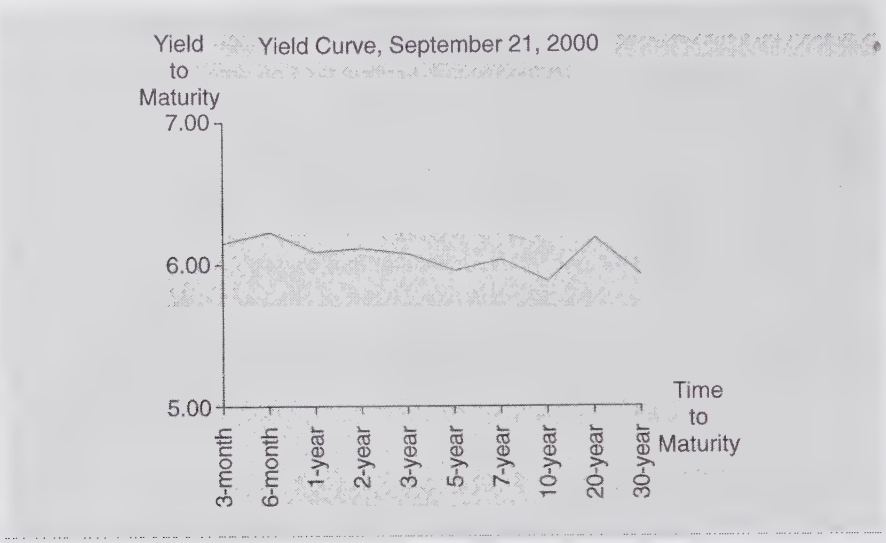
FIGURE 2–15B



Source: U.S. Treasury, Daily Treasury Yield Curves, various states. **www.ustreas.gov**

7. As we discuss in Chapter 3, only debt securities have an identifiable maturity date; equity securities do not.

FIGURE 2–15C



yield to maturity curve for U.S. Treasury securities is the most frequently reported and analyzed yield to maturity curve. The shape of the yield curve on Treasury securities has taken many forms over the years, but the three most common shapes are shown in Figure 2–15. In graph (a), the yield curve on August 12, 2004, yields rise steadily with maturity when the yield curve is upward sloping. This is the most common yield curve, so that on average the MP is positive. Graph (b) shows an inverted or downward-sloping yield curve, reported on November 27, 2000, for which yields decline as maturity increases. Inverted yield curves do not generally last very long. Finally, graph (c) shows a flat yield curve, reported on September 21, 2000, in which the yield to maturity is virtually unaffected by the term to maturity.[8]

Note that these yield curves may reflect factors other than investors' preferences for the maturity of a security, since in reality there may be liquidity differences among the securities traded at different points along the yield curve. For example, newly issued 20-year Treasury bonds offer a rate of return less than (seasoned issues) 10-year Treasury bonds if investors prefer new ("on the run") securities to previously issued ("off the run") securities. Specifically, since (historically) the Treasury only issues new 10-year notes and 20-year bonds at the long end of the maturity spectrum, an existing 10-year Treasury bond would have to have been issued 10 years previously (i.e., it was originally a 20-year bond when it was issued 10 years previously). The increased demand for the newly issued "liquid" 20-year Treasury bonds relative to the less liquid 10-year Treasury bonds can be large enough to push the equilibrium interest rate on the 20-year Treasury bonds below that on the 10-year Treasury bonds and even below short-term rates. In the next section, we review three major theories that are often used to explain the shape of the yield to maturity curve.

Putting the factors that impact interest rates in different markets together, we can use the following general equation to determine the factors that functionally impact the fair interest rate (i_j^*) on an individual (jth) financial security:

$$i_j^* = f(IP, RIR, DRP_j, LRP_j, SCP_j, MP_j) \quad (9)$$

8. Yield curves from the last 15 years can be viewed at **stockcharts.com/charts/yieldcurve.html.** A look at this Web site reveals how infrequently inverted or flat yield curves occur.

DO YOU UNDERSTAND?

where

IP = Inflation premium
RIR = Real interest rate
DRP_j = Default risk premium on the jth security
LRP_j = Liquidity risk premium on the jth security
SCP_j = Special feature premium on the jth security
MP_j = Maturity premium on the jth security

The first two factors, IP and RIR, are common to all financial securities, while the other factors can be unique to each security.

TERM STRUCTURE OF INTEREST RATES

8

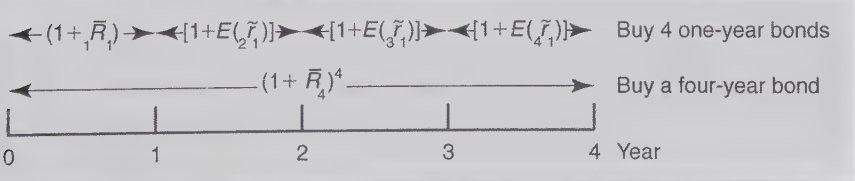
As discussed above in the context of the maturity premium, the relationship between a security's interest rate and its remaining term to maturity (the term structure of interest rates) can take a number of different shapes. Explanations for the shape of the yield curve fall predominantly into three theories: the unbiased expectations theory, the liquidity premium theory, and the market segmentation theory. Review again Figure 2–15(a), which presents the Treasury yield curve as of August 12, 2004. As can be seen, the yield curve on this date reflected the normal upward-sloping relationship between yield and maturity.

Unbiased Expectations Theory

According to the unbiased expectations theory of the term structure of interest rates, at a given point in time the yield curve reflects the market's current expectations of future short-term rates. As illustrated in Figure 2–16, the intuition behind the unbiased expectations theory is that if investors have a four-year investment horizon, they could either buy a current, four-year bond and earn the current or spot yield on a four-year bond (${}_1\bar{R}_4$, if held to maturity) each year, or could invest in four successive one-year bonds (of which they only know the current one-year spot rate (${}_1\bar{R}_1$), but form expectations of the unknown future one-year rates [$E({}_2\tilde{r}_1)$, $E({}_3\tilde{r}_1)$, and $E({}_4\tilde{r}_1)$]). Note that each interest rate term has two subscripts, for example, ${}_1\bar{R}_4$. The first subscript indicates the period in which the security is bought, so that 1 represents the purchase of a security in period 1. The second subscript indicates the maturity on the security, so that 4 represents the purchase of a security with a four-year life. Similarly, $E({}_3\tilde{r}_1)$ is the expected return on a security with a one-year life purchased in period 3.

In equilibrium, the return to holding a four-year bond to maturity should equal the expected return to investing in four successive one-year bonds. If this equality does not hold, an arbitrage opportunity exists. For example, if the investor could earn more on the one-year bond investments, he could short (or sell) the four-year bond, use the proceeds to buy the four successive one-year bonds, and earn a guaranteed profit over the four-year investment horizon. Thus, according to the unexpected expectations hypothesis, if future one-year rates are expected to rise each successive year into the future, then the yield curve will slope upwards. Specifically, the current four-year T-bond rate or return will exceed the three-bond rate, which will exceed the two-year bond rate, and so on. Similarly, if future one-year rates are expected to remain constant each successive year into the future, then the four-year bond rate will be equal to the three-year bond rate—that is, the term structure of interest rates will remain

FIGURE 2–16 Unbiased Expectation Theory of the Term Structure of Interest Rates



constant over the relevant time period. Specifically, the unbiased expectation theory posits that current long-term interest rates are geometric averages of current and expected *future* short-term interest rates. The mathematical equation representing this relationship is:

$$(1 + {}_1\bar{R}_N)^N = (1 + {}_1\bar{R}_1)(1 + E({}_2\tilde{r}_1)) \ldots (1 + E({}_N\tilde{r}_1)) \quad (10)$$

therefore:

$${}_1\bar{R}_N = [(1 + {}_1\bar{R}_1)(1 + E({}_2\tilde{r}_1)) \ldots (1 + E({}_N\tilde{r}_1))]^{1/N} - 1$$

where

${}_1\bar{R}_N$ = Actual N-period rate today (i.e., the first day of year 1)

N = Term to maturity, $N = 1, 2, \ldots, 4, \ldots$

${}_1\bar{R}_1$ = Actual current 1-year rate today

$E({}_i\tilde{r}_1)$ = Expected one-year rates for years, $i = 2, 3, 4, \ldots, N$ in the future

Notice, as above, that uppercase interest rate terms, ${}_1\bar{R}_t$, are the actual current interest rates on securities purchased today with a maturity of t years. Lowercase interest rate terms, ${}_t\tilde{r}_1$, are estimates of future one-year interest rates starting t years into the future.

EXAMPLE 2-7 Construction of a Yield Curve Using the Unbiased Expectations Theory of the Term Structure of Interest Rates

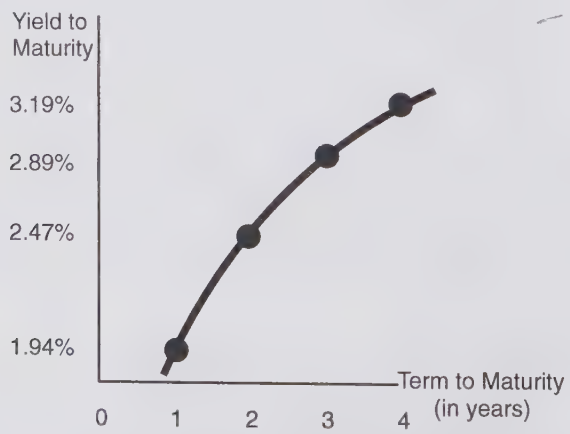
Suppose that the current one-year rate (one-year spot rate) and expected one-year T-bond rates over the following three years (i.e., years 2, 3, and 4, respectively) are as follows:

$${}_1\bar{R}_1 = 1.94\%,\ E({}_2\tilde{r}_1) = 3.00\%,\ E({}_3\tilde{r}_1) = 3.74\%,\ E({}_4\tilde{r}_1) = 4.10\%$$

Using the unbiased expectations theory, current (or today's) rates for one-, two-, three-, and four-year maturity Treasury securities should be:

$${}_1\bar{R}_1 = 1.94\%$$
$${}_1\bar{R}_2 = [(1 + .0194)(1 + .03)]^{1/2} - 1 = 2.47\%$$
$${}_1\bar{R}_3 = [(1 + .0194)(1 + .03)(1 + .0374)]^{1/3} - 1 = 2.89\%$$
$${}_1\bar{R}_4 = [(1 + .0194)(1 + .03)(1 + .0374)(1 + .041)]^{1/4} - 1 = 3.19\%$$

and the current yield to maturity curve will be upward sloping as shown:



This upward-sloping yield curve reflects the market's expectation of persistently rising one-year (short-term) interest rates over the future horizon.[9]

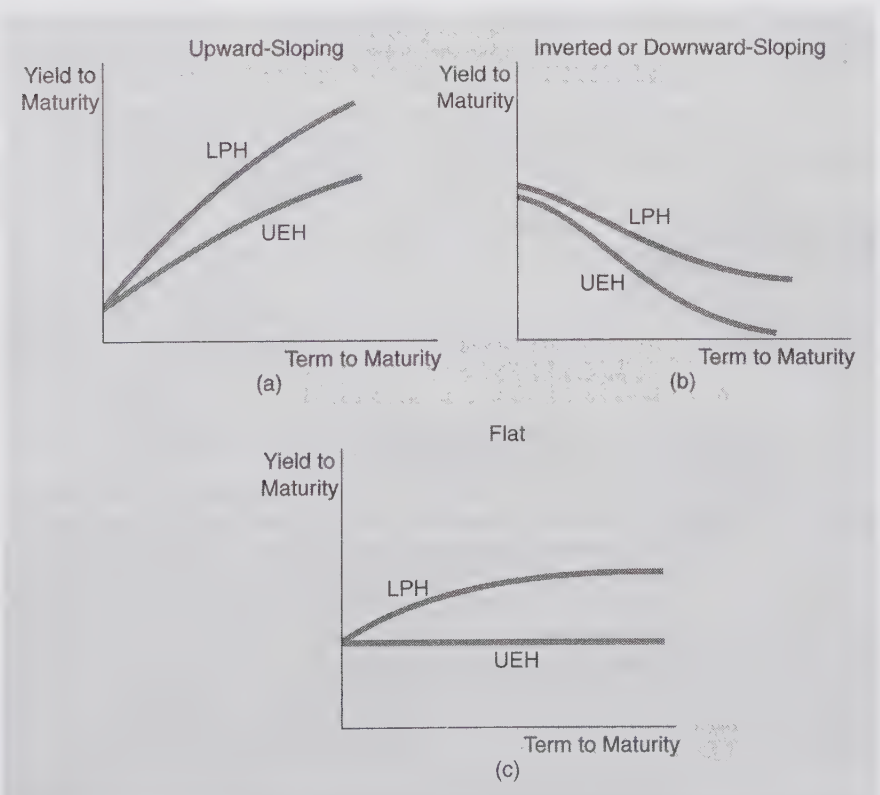
9. That is, $E({}_4\tilde{r}_1) > E({}_3\tilde{r}_1) > E({}_2\tilde{r}_1) > {}_1\bar{R}_1$

Liquidity Premium Theory

The second theory, the liquidity premium theory of the term structure of interest rates, is an extension of the unbiased expectations theory. It is based on the idea that investors will hold long-term maturities only if they are offered at a premium to compensate for future uncertainty in a security's value, which increases with an asset's maturity. Specifically, in a world of uncertainty, short-term securities provide greater marketability (due to their more active secondary market) and have less price risk (due to smaller price fluctuations for a given change in interest rates) than long-term securities. As a result, investors prefer to hold shorter-term securities because they can be converted into cash with little risk of a capital loss, i.e., a fall in the price of the security below its original purchase price. Thus, investors must be offered a liquidity premium to buy longer-term securities which have a higher risk of capital losses. This difference in price or liquidity risk can be directly related to the fact that longer-term securities are more sensitive to interest rate changes in the market than are shorter-term securities—see Chapter 3 for a discussion on bond interest rate sensitivity and the link to a bond's maturity or duration. Because the longer the maturity on a security the greater its risk, the liquidity premium increases as maturity increases.

The liquidity premium theory states that long-term rates are equal to geometric averages of current and expected short-term rates (as under the unbiased expectations theory), plus liquidity risk premiums that increase with the maturity of the security. Figure 2–17 illustrates the differences in the shape of the yield curve under the unbiased expectations hypothesis versus the liquidity premium hypothesis. For example, according to the liquidity

FIGURE 2–17 **Yield Curve under the Unbiased Expectations Hypotheses (UEH) versus the Liquidity Premium Hypothesis (LPH)**



premium theory, an upward-sloping yield curve may reflect investors' expectations that future short-term rates will be flat, but because liquidity premiums increase with maturity, the yield curve will nevertheless be upward sloping. Indeed, an upward-sloping yield curve may reflect expectations that future interest rates will rise, be flat, or even fall, as long as the liquidity premium increases with maturity fast enough to produce an upward-sloping yield curve. The liquidity premium theory may be mathematically represented as:

$$ {}_1\bar{R}_N = [(1 + {}_1\bar{R}_1)(1 + E({}_2\tilde{r}_1) + {}_{L_2}) \ldots (1 + E({}_N\tilde{r}_1) + L_N)]^{1/N} - 1 \quad (11) $$

where

L_t = Liquidity premium for a period t
$L_2 < L_3 < \ldots L_N$

The Appendix to this chapter (located at the book's Web site, **www.mhhe.com/sc3e** provides an example in which we construct a yield curve using the liquidity premium hypothesis.

Market Segmentation Theory

The market segmentation theory argues that individual investors and FIs have specific maturity preferences, and to get them to hold securities with maturities other than their most preferred requires a higher interest rate (maturity premium). Accordingly, the market segmentation theory does not consider securities with different maturities as perfect substitutes. Rather, individual investors and FIs have preferred investment horizons (habitats) dictated by the nature of the liabilities they hold. For example, banks might prefer to hold relatively short-term U.S. Treasury bonds because of the short-term nature of their deposit liabilities, while insurance companies may prefer to hold long-term U.S. Treasury bonds because of the long-term nature of their life insurance contractual liabilities. Accordingly, interest rates are determined by distinct supply and demand conditions within a particular maturity segment (e.g., the short end and long end of the bond market). The market segmentation theory assumes that investors and borrowers are generally unwilling to shift from one maturity sector to another without adequate compensation in the form of an interest rate premium. Figure 2–18 demonstrates how changes in the supply curve for short- versus long-term bond segments of the market results in changes in the shape of the yield to maturity curve. Specifically in Figure 2–18, the higher the yield on securities (the lower the price), the higher the demand for them.[10]

www.ustreas.gov

DO YOU UNDERSTAND?

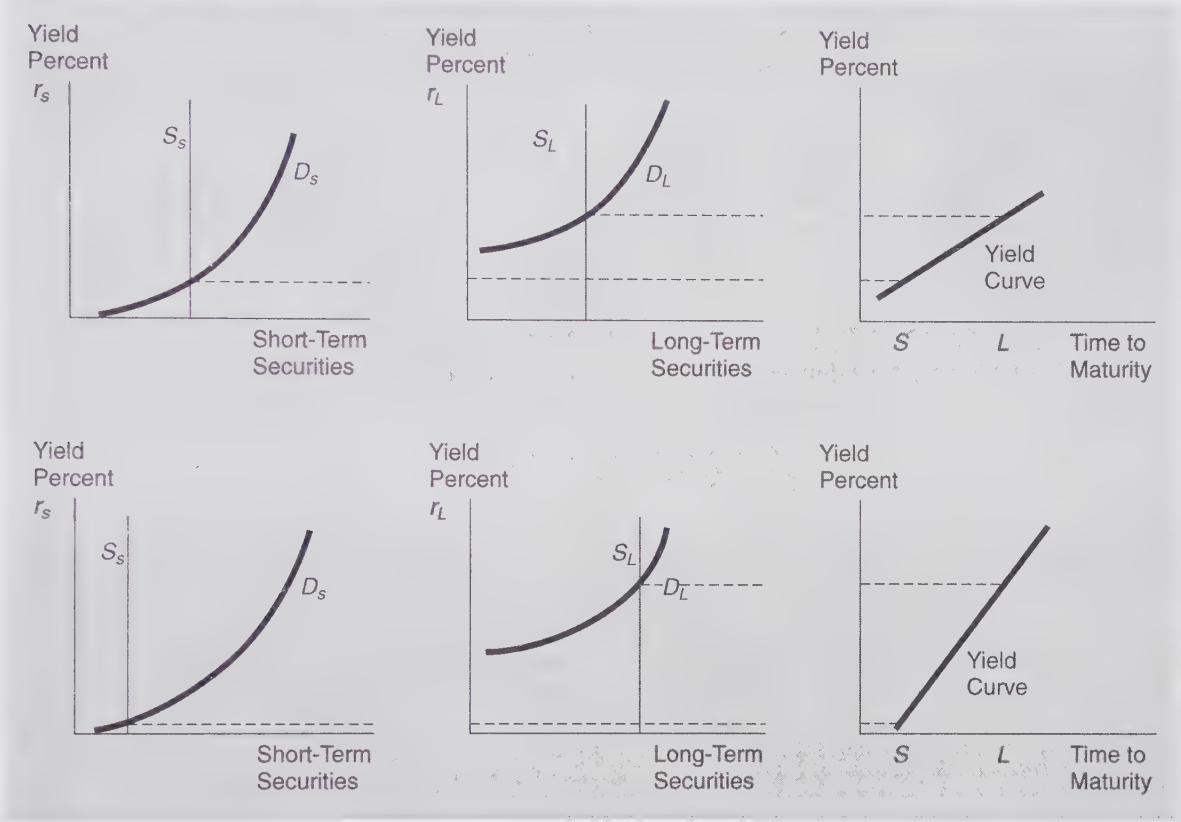
Thus, as the *supply* of securities *decreases in the short-term* market and *increases in the long-term* market, the *slope* of the yield curve *becomes steeper.* If the *supply* of *short-term* securities had *increased* while the *supply* of *long-term* securities had *decreased,* the *yield curve would have a flatter slope* and might even have sloped downward. Indeed, the large-scale repurchases of long-term Treasury bonds (i.e., reductions in supply) by the U.S. Treasury in early 2000 has been viewed as the major cause of the inverted yield curve that appeared in February 2000.

9 FORECASTING INTEREST RATES

As seen in the time value of money examples at the beginning of this chapter, as interest rates change, so do the values of financial securities. Accordingly, the ability to predict or forecast interest rates is critical to the profitability of financial institutions and individual investors alike. For example, if interest rates rise, the value of investment portfolios of FIs and individuals will fall, resulting in a loss of wealth. Thus, interest rate forecasts are extremely important for the financial wealth of both FIs and individuals. The discussion of the unbiased expectations hypothesis in the previous section of this chapter indicated that the shape of the yield curve is determined by the market's current expectations of future

10. In general, the price and yield on a bond are inversely related. Thus, as the price of a bond falls (becomes cheaper), the demand for the bond will rise. This is the same as saying that as the yield on a bond rises, it becomes cheaper and the demand for it increases.

FIGURE 2–18 Market Segmentation and Determination of the Slope of Yield Curve



short-term interest rates. For example, an upward-sloping yield curve suggests that the market expects future short-term interest rates to increase. Given that the yield curve represents the market's current expectations of future short-term interest rates, the unbiased expectations hypothesis can be used to forecast (short-term) interest rates in the future (i.e., forward one-year interest rates). A **forward rate** is an expected or "implied" rate on a short-term security that is to be originated at some point in the future. Using the equations representing unbiased expectations theory, the market's expectation of forward rates can be derived directly from existing or actual rates on securities currently traded in the spot market.

forward rate

An expected rate (quoted today) on a security that originates at some point in the future.

EXAMPLE 2–8 Calculation of Implied Forward Rates on One-Year Securities Using the Unbiased Expectations Hypothesis

To find an implied forward rate on a one-year security to be issued one year from today, the unbiased expectations hypothesis equation can be rewritten as follows:

$$ {}_1\bar{R}_2 = [(1 + {}_1\bar{R}_1)(1 + ({}_2f_1))]^{1/2} - 1 $$

where

${}_2f_1$ = Expected one-year rate for year 2, or the implied forward one-year rate for next year

Therefore, ${}_2f_1$ is the market's estimate of the expected one-year rate for year 2. Solving for ${}_2f_1$, we get:

$$ {}_2f_1 = [(1 + {}_1\bar{R}_2)^2/(1 + {}_1\bar{R}_1)] - 1 $$

In general, we can find the one-year forward rate for any year, N years into the future using the following equation:

$$_Nf_1 = [(1 + {}_1\bar{R}_N)^N/(1 + {}_1\bar{R}_{N-1})^{N-1}] - 1 \quad (12)$$

DO YOU UNDERSTAND?

For example, on August 16, 2004, the existing or current (spot) one-year, two-year, three-year, and four-year zero-coupon Treasury security rates were as follows:

$$_1\bar{R}_1 = 1.94\%,\ _1\bar{R}_2 = 2.54\%,\ _1\bar{R}_3 = 3.17\%,\ _1\bar{R}_4 = 3.44\%$$

Using the unbiased expectations theory, one-year forward rates on zero-coupon Treasury bonds for years 2, 3, and 4 as of August 16, 2004, were:

$$_2f_1 = [(1.0254)^2/(1.0194)] - 1 = 3.144\%$$
$$_3f_1 = [(1.0317)^3/(1.0254)^2] - 1 = 4.444\%$$
$$_4f_1 = [(1.0344)^4/(1.0317)^3] - 1 = 4.254\%$$

Thus, the expected one-year rate, one year in the future, was 3.144 percent; the expected one-year rate, two years into the future, was 4.444 percent; and the expected one-year rate three years into the future was 4.254 percent.

SUMMARY

This chapter reviewed the determinants of nominal interest rates and their effects on security prices and values in domestic and foreign financial markets. It described the way funds flow through the financial system from lenders to borrowers and how the level of interest rates and its movements over time are determined. The chapter also introduced theories regarding the determination of the shape of the term structure of interest rates.

SEARCH THE SITE

Go to the Federal Reserve Board's Web site and get the latest rates on 10-year T-bond and Aaa- and Baa-rated corporate bonds.

Go to the Federal Reserve's Web site at **www.federalreserve.gov**

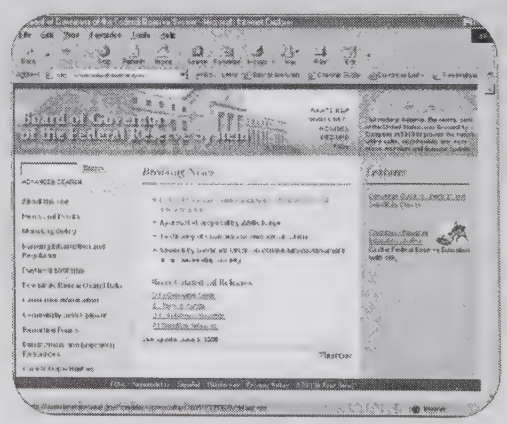
Click on "Economic Research and Data"

Click on "Statistics: Releases and Historical Data"

Click on "Weekly Releases: Selected Interest Rates: Releases"

Click on the most recent date.

This will bring the file onto your computer that contains the relevant data.



Questions

1. Calculate the percentage change in the 10-year T-bond and Aaa- and Baa-rated corporate bonds since March 2004.
2. Calculate the current spread of Aaa- and Baa-rated corporate bonds over the 10-year T-bond rate. How have these spreads changed over the last two years?

QUESTIONS

1. What is the difference between simple interest and compound interest?
2. Calculate the present value of $5,000 received five years from today if your investments pay
   a. 6 percent compounded annually
   b. 8 percent compounded annually
   c. 10 percent compounded annually
   d. 10 percent compounded semiannually
   e. 10 percent compounded quarterly

   What do your answers to these questions tell you about the relation between present values and interest rates and between present values and the number of compounding periods per year?
3. Calculate the future value in five years of $5,000 received today if your investments pay
   a. 6 percent compounded annually
   b. 8 percent compounded annually
   c. 10 percent compounded annually
   d. 10 percent compounded semiannually
   e. 10 percent compounded quarterly

   What do your answers to these questions tell you about the relation between future values and interest rates and between future values and the number of compounding periods per year?
4. Calculate the present value of the following annuity streams:
   a. $5,000 received each year for 5 years on the last day of each year if your investments pay 6 percent compounded annually.
   b. $5,000 received each quarter for 5 years on the last day of each quarter if your investments pay 6 percent compounded quarterly.
   c. $5,000 received each year for 5 years on the first day of each year if your investments pay 6 percent compounded annually.
   d. $5,000 received each quarter for 5 years on the first day of each quarter if your investments pay 6 percent compounded quarterly.
5. Calculate the future value of the following annuity streams:
   a. $5,000 received each year for 5 years on the last day of each year if your investments pay 6 percent compounded annually.
   b. $5,000 received each quarter for 5 years on the last day of each quarter if your investments pay 6 percent compounded quarterly.
   c. $5,000 received each year for 5 years on the first day of each year if your investments pay 6 percent compounded annually.
   d. $5,000 received each quarter for 5 years on the first day of each quarter if your investments pay 6 percent compounded quarterly.
6. For each of the following, compute the future value:

Present Value	Years	Interest Rate	Future Value
$ 2,250	4	18%	
9,310	9	6	
76,355	15	12	
183,796	21	8	

7. **Using a Spreadsheet to Calculate Future Values.** What is the future value of $100,000 invested for 12 years at 5 percent, 6 percent, 8 percent, and 10 percent, compounded annually?

Present Value	Interest Periods	Rate	=>	The Answer Will Be
$100,000	12	5%		$179,585.63
100,000	12	6		201,219.65
100,000	12	8		251,817.01
100,000	12	10		313,842.84

8. For each of the following, compute the present value:

Present Value	Years	Interest Rate	Future Value
	6	4%	$ 15,451
	8	12	51,557
	16	22	886,073
	25	20	550,164

9. **Using a Spreadsheet to Calculate Present Values.** What is the present value of $100,000 invested for 12 years at 5 percent, 6 percent, 8 percent, and 10 percent compounded annually?

Future Value	Periods	Interest Rate	=>	The Answer Will Be
$100,000	12	5%		$55,683.74
100,000	12	6		49,696.94
100,000	12	8		39,711.38
100,000	12	10		31,863.08

10. Compute the future values of the following first assuming that payments are made on the last day of the period and then assuming payments are made on the first day of the period:

Payment	Years	Interest Rate	Future Value (Payment made on last day of period)	Future Value (Payment made on first day of period)
$ 123	13	13%		
4,555	8	8		
74,484	5	10		
167,332	9	1		

11. **Using a Spreadsheet to Calculate Future Value of Annuities.** What is the future value of $1,000 invested each month for 10 years at 5 percent, 6 percent, 8 percent, and 10 percent, compounded monthly?

Annuity Payment	Periods	Interest Rate	=>	The Answer Will Be
$1,000	10 × 12 = 120	5%		$155,282.28
1,000	120	6		163,879.35
1,000	120	8		182,946.04
1,000	120	10		204,844.98

12. Compute the present values of the following first assuming that payments are made on the last day of the period and then assuming payments are made on the first day of the period:

Payment	Years	Interest Rate	Present Value (Payment made on last day of period)	Present Value (Payment made on first day of period)
$ 678.09	7	13%		
7,968.26	13	6		
20,322.93	23	4		
69,712.54	4	31		

13. **Using a Spreadsheet to Calculate Present Values.** What is the present value of $100,000 invested for 12 years at 5 percent, 6 percent, 8 percent, and 10 percent, compounded semiannually?

Future Value	Periods	Interest Rate	=>	The Answer Will Be
$100,000	12 × 2 = 24	5%		$55,287.54
100,000	24	6		49,193.37
100,000	24	8		39,012.15
100,000	24	10		31,006.79

14. What is the future value of $950 paid on the last day of each 6 months for 12 years assuming an interest rate of 11 percent compounded semiannually?
15. Calculate the effective annual return on an investment offering a 12 percent interest rate, compounded monthly.
16. Who are the suppliers of loanable funds?
17. Who are the demanders of loanable funds?
18. What factors cause the supply of funds curve to shift?
19. What factors cause the demand for funds curve to shift?
20. A particular security's equilibrium rate of return is 8 percent. For all securities, the inflation risk premium is 1.75 percent and the real interest rate is 3.5 percent. The security's liquidity risk premium is .25 percent and maturity risk premium is .85 percent. The security has no special covenants. Calculate the security's default risk premium.
21. If we observe a one-year Treasury security rate higher than the two-year Treasury security rate, what can we infer about the one-year rate expected one year from now?
22. The current one-year Treasury-bill rate is 5.2 percent, and the expected one-year rate 12 months from now is 5.8 percent. According to the unbiased expectations theory, what should be the current rate for a two-year Treasury security?
23. Suppose that the current one-year rate (one-year spot rate) and expected one-year T-bill rates over the following three years (i.e., years 2, 3, and 4, respectively) are as follows:

$$ {}_1\bar{R}_1 = 6\%,\ E({}_2\tilde{r}_1) = 7\%,\ E({}_3\tilde{r}_1) = 7.5\%,\ E({}_4\tilde{r}_1) = 7.85\% $$

Using the unbiased expectations theory, calculate the current (long-term) rates for one-, two-, three-, and four-year-maturity Treasury securities. Plot the resulting yield curve.

24. Suppose we observe the following rates: ${}_1\bar{R}_1 = 8\%$, ${}_1\bar{R}_2 = 10\%$. If the unbiased expectations theory of the term structure of interest rates holds, what is the one-year interest rate expected one year from now, $E({}_2\tilde{r}_1)$?
25. Suppose we observe the three-year Treasury security rate (${}_1\bar{R}_3$) to be 12 percent, the expected one-year rate next year—$E({}_2\tilde{r}_1)$—to be 8 percent, and the expected one-year rate the following year—$E({}_3\tilde{r}_1)$—to be 10 percent. If the unbiased expectations theory of the term structure of interest rates holds, what is the one-year Treasury security rate?
26. A recent edition of *The Wall Street Journal* reported interest rates of 2.25 percent, 2.60 percent, 2.98 percent, and 3.25 percent for three-year, four-year, five-year, and six-year Treasury note yields, respectively, According to the unbiased expectation theory of the term structure of interest rates, what are the expected one-year rates for years 4, 5, and 6?
27. How does the liquidity premium theory of the term structure of interest rates differ from the unbiased expectations theory? In a normal economic environment, that is, an upward-sloping yield curve, what is the relationship of liquidity premiums for successive years into the future? Why?
28. Based on economists' forecasts and analysis, one-year Treasury bill rates and liquidity premiums for the next four years are expected to be as follows:

$$ {}_1\bar{R}_1 = 5.65\% $$
$$ E({}_2\tilde{r}_1) = 6.75\% \qquad L_2 = 0.05\% $$
$$ E({}_3\tilde{r}_1) = 6.85\% \qquad L_3 = 0.10\% $$
$$ E({}_4\tilde{r}_1) = 7.15\% \qquad L_4 = 0.12\% $$

Using the liquidity premium hypothesis, plot the current yield curve. Make sure you label the axes on the graph and identify the four annual rates on the curve both on the axes and on the yield curve itself.

29. Suppose we observe the following rates: ${}_1\bar{R}_1 = .10$, ${}_1\bar{R}_2 = .14$, and $E({}_2\tilde{r}_1) = .10$. If the liquidity premium theory of the term structure of interest rates holds, what is the liquidity premium for year 2?
30. If you note the following yield curve in *The Wall Street Journal*, what is the one-year forward rate for the period beginning two years from today, ${}_2f_1$ according to the unbiased expectations hypothesis?

Maturity	Yield
One day	2.00%
One year	5.50
Two years	6.50
Three years	9.00

31. A recent edition of *The Wall Street Journal* reported interest rates of 6 percent, 6.35 percent, 6.65 percent, and 6.75 percent for three-year, four-year, five-year, and six-year Treasury notes, respectively. According to the unbiased expectations hypothesis, what are the expected one-year rates for years 4, 5, and 6 (i.e., what are ${}_4f_1$, ${}_5f_1$, and ${}_6f_1$)?

32. Assume the current interest rate on a one-year Treasury bond (${}_1\bar{R}_1$) is 4.50 percent, the current rate on a two-year Treasury bond (${}_1\bar{R}_2$) is 5.25 percent, and the current rate on a three-year Treasury bond (${}_1\bar{R}_3$) is 6.50 percent. If the unbiased expectations theory of the term structure of interest rates is correct, what is the one-year interest rate expected on Treasury bills during year 3 ($E({}_3\tilde{r}_1)$ or ${}_3f_1$)?

APPENDIX 2A: Construction of a Yield Curve Using the Liquidity Premium Theory of the Term Structure of Interest Rates

View this appendix at
www.mhhe.com/sc3e

Chapter 3

Interest Rates *and* Security Valuation

Chapter NAVIGATOR

1. What are the differences in the required rate of return, the expected rate of return, and the realized rate of return?
2. How are bonds valued?
3. How can security prices be affected by interest rate changes?
4. How do the maturity and coupon rate on a security affect its price sensitivity to interest rate changes?
5. What is duration?
6. How do maturity, yield to maturity, and coupon interest affect the duration of a security?
7. What is the economic meaning of duration?

OUTLINE

INTEREST RATES AS A DETERMINANT OF FINANCIAL SECURITY VALUES: CHAPTER OVERVIEW

In Chapter 2, we introduced the basic concepts of time value of money and how time value of money equations can be used to convert cash flows received or paid over an investment horizon into either a present value or future value. Of particular importance was the fact that interest rate levels, and changes in interest rate levels, affect security values. We also reviewed the factors that determine the level of interest rates, changes in interest rates, and interest rate differences among securities (e.g., default risk, callability).

With this understanding of how and why interest rates change, in this chapter we apply time value of money principals to the valuation of specific financial securities, paying particular attention to the change in a security's value when interest rates change. We examine how characteristics specific to a financial security (e.g., its coupon rate and remaining time

TABLE 3–1 Various Interest Rate Measures

Coupon Rate—interest rate on a bond instrument used to calculate the annual cash flows the bond issuer promises to pay the bond holder.
Required Rate of Return—interest rate an investor should receive on a security given its risk. Required rate of return is used to calculate the fair present value on a security.
Expected Rate of Return—interest rate an investor would receive on a security if he or she buys the security at its current market price, receives all expected payments, and sells the security at the end of his or her investment horizon.
Realized Rate of Return—actual interest rate earned on an investment in a financial security. Realized rate of return is a historical (ex post) measure of the interest rate.

to maturity) also influence a financial security's price.[1] We conclude the chapter with an analysis of the duration of a security. Duration, which measures the weighted-average time to maturity of an asset or liability, using the present values of the cash flows as weights, also has economic meaning as the sensitivity of an asset or liability's value or price to a small interest rate change. The valuation and duration models reviewed in this chapter are used by traders to determine whether to transact in the various financial markets we discuss in Chapters 5 through 10.

1 VARIOUS INTEREST RATE MEASURES

In Chapter 2, we presented a general discussion of interest rates and how they are determined. The term *interest rates* can actually have many different meanings depending on the time frame used for analysis and the type of security being analyzed. In this chapter, we start off by defining the different interest rate measures employed in the valuation of financial securities by market participants. These definitions are summarized in Table 3–1. In the body of the chapter we apply these rates to the valuation of bonds (bond markets and their operations are discussed in detail in Chapter 6). In Appendix 3A to this chapter, located at the book's Web site (**www.mhhe.com/sc3e**), we apply these rates to the valuation of stocks (stock markets and their operations are discussed in Chapter 9).

Coupon Rate

coupon interest rate
Interest rate used to calculate the annual cash flow the bond issuer promises to pay the bond holder.

One variation on the meaning of the term *interest rate* specific to debt instruments is the **coupon interest rate** paid on a bond. As discussed in detail in the next section, the coupon rate on a bond instrument is the annual (or periodic) cash flow that the bond issuer contractually promises to pay the bond holder. This coupon rate is only one component of the overall return (required, expected, or realized rate of return) the bond holder earns on a bond, however. As discussed below, required, expected, or realized rates of return incorporate not only the coupon payments but all cash flows on a bond investment, including full and partial repayments of principal by the issuer.

Required Rate of Return

Market participants use time value of money equations to calculate the fair present value of a financial security over an investment horizon. As we discussed in Chapter 2 and will see later on in this chapter, this process involves the discounting of all projected cash

1. Security valuation is a topic that finance students probably studied in introductory financial management courses. However, these models are critical tools for traders of financial securities and managers of financial institutions. Therefore, in this chapter we review and provide a reference guide to the general pricing relationships. This material can be included or dropped from the chapter reading, depending on the need for review of the material, without harming the continuity of the chapter.

required rate of return
The interest rate an investor should receive on a security, given its risk.

flows (CFs)[2] on the security at an appropriate interest rate. The interest rate used to find the fair present value of a financial security is called the **required rate of return** (rrr). This interest rate is a function of the various risks associated with a security (discussed in Chapter 2) and is thus the interest rate the investor *should* receive on the security given its risk (default risk, liquidity risk, etc.). The required rate of return is thus an ex ante (before the fact) measure of the interest rate on a security. The *fair present value* (FPV) is determined by the following formula:

$$FPV = \frac{\tilde{CF}_1}{(1+rrr)^1} + \frac{\tilde{CF}_2}{(1+rrr)^2} + \frac{\tilde{CF}_3}{(1+rrr)^3} + \cdots + \frac{\tilde{CF}_n}{(1+rrr)^n}$$

where

rrr = Required rate of return
$\tilde{CF}_t$ = Cash flow projected in period t ($t = 1, \ldots, n$)
$\sim$ = Indicates that projected cash flow is uncertain (because of default and other risks)
n = Number of periods in the investment horizon

Once an FPV is calculated, market participants then compare this fair present value with the *current market price* (P) at which the security is trading in a financial market. If the current market price of the security (P) is less than its fair value (FPV), the security is currently undervalued. The market participant would want to buy more of this security at its current price. If the current market price of the security is greater than its fair present value, the security is overvalued. The market participant would not want to buy this security at its current price. If the fair present value of the security equals its current market price, the security is said to be fairly priced given its risk characteristics. In this case, FPV equals P.

EXAMPLE 3–1 Application of Required Rate of Return

A bond you purchased two years ago for $890 is now selling for $925. The bond paid $100 per year in coupon interest on the last day of each year (the last payment made today). You intend to hold the bond for four more years and project that you will be able to sell it at the end of year 4 for $960. You also project that the bond will continue paying $100 in interest per year. Given the risk associated with the bond, its required rate of return (rrr) over the next four years is 11.25 percent. Accordingly, the bond's fair present value is:

$$FPV = \frac{100}{(1+.1125)^1} + \frac{100}{(1+.1125)^2} + \frac{100}{(1+.1125)^3} + \frac{100+960}{(1+.1125)^4}$$
$$= \$935.31$$

Given the current selling price of the bond, $925, relative to the fair present value, $935.31, this bond is currently undervalued.

expected rate of return
The interest rate an investor would earn on a security if he or she buys the security at its current market price, receives all promised or expected payments on the security, and sells the security at the end of his or her investment horizon.

Expected Rate of Return

The **expected rate of return** (Err) on a financial security is the interest rate a market participant *would* earn by buying the security at its *current market price* (P), receiving all the projected cash flow payments ($\tilde{CF}s$) on the security, and selling the security when the security matures at the end of the participant's investment horizon. Thus, the expected

2. The projected cash flows used in these equations may be those promised by the security issuer or expected cash flows estimated by the security purchaser (or some other analyst) from a probability distribution of the possible cash flows received on the security. In either case, the cash flows received are not ex ante known with perfect certainty because of default and other risks.

TABLE 3–2 The Relation between Required Rate of Return and Expected Rate of Return

$Err \geq rrr$, or $P \leq FPV$	The present value of the cash flows received on the security is greater than or equal to that required to compensate for the risk incurred from investing in the security. Thus, buy this security.
$Err < rrr$, or $P > FPV$	The present value of the cash flows received on the security is less than that required to compensate for the risk incurred from investing in the security. Thus, do not buy this security.

rate of return is also an ex ante measure of the interest rate on a security. However, the expected rate of return on an investment is based on the current market price rather than fair present value. As discussed above, these may or may not be equal.

Again, time value of money equations are used to calculate the expected rate of return on a security. In this case, the current market price of the security is set equal to the present value of all projected cash flows received on the security over the investment horizon. The expected rate of return is the discount rate in the present value equations that just makes the present value of projected cash flows equal to its current market price (P).[3] That is:

$$P = \frac{\widetilde{CF}_1}{(1 + Err)^1} + \frac{\widetilde{CF}_2}{(1 + Err)^2} + \frac{\widetilde{CF}_3}{(1 + Err)^3} + \cdots + \frac{\widetilde{CF}_n}{(1 + Err)^n}$$

where

Err = Expected rate of return
$\widetilde{CF}_t$ = Cash flow projected in period t ($t = 1, \ldots, n$)
n = Number of periods in the investment horizon
$\sim$ = Indicates that cash flows in the future are uncertain

Once an expected rate of return (Err) on a financial security is calculated, the market participant compares this expected rate of return to its required rate of return (rrr). If the expected rate of return is greater than the required rate of return, the projected cash flows on the security are greater than is required to compensate for the risk incurred from investing in the security. Thus, the market participant would want to buy more of this security. If the expected rate of return is less than the required rate of return, the projected cash flows from the security are less than those required to compensate for the risk involved. Thus, the market participant would not want to invest more in the security.[4] We summarize these relationships in Table 3–2.

EXAMPLE 3–2 Application of Expected Rate of Return

Refer to information in Example 3–1 describing a bond you purchased two years ago for $890. Using the current market price of $925, the expected rate of return on the bond over the next four years is calculated as follows:

$$925 = \frac{100}{(1 + Err)^1} + \frac{100}{(1 + Err)^2} + \frac{100}{(1 + Err)^3} + \frac{100 + 960}{(1 + Err)^4}$$

$$\Rightarrow Err = 11.607\%$$

Given that the required return on the bond is 11.25 percent, the projected cash flows on the bond are greater than is required to compensate you for the risk on the bond.

3. We are also assuming that any cash flows on the investment can be reinvested to earn the same expected rate of return.

4. Note also that by implication, if $Err > rrr$, then the market price of a security (P) is less than its fair present value (FPV) and vice versa if $Err < rrr$.

Required versus Expected Rates of Return: The Role of Efficient Markets

We have defined two ex ante (before the fact) measures of interest rates. The *required* rate of return is used to calculate a *fair* present value of a financial security, while the *expected* rate of return is a discount rate used in conjunction with the *current* market price of a security to calculate an ex ante (or before the fact) return. As long as financial markets are efficient (see below), the current market price of a security tends to equal its fair price present value. This is the case most of the time. However, when an event occurs that unexpectedly changes interest rates or a characteristic of a financial security (e.g., an unexpected dividend increase, an unexpected decrease in default risk), the current market price of a security can temporarily diverge from its fair present value. When investors determine a security is undervalued (i.e., its current market price is less than its fair present value), demand for the security increases, as does its price. Conversely, when investors determine a security is overvalued (i.e., its current market price is greater than its fair present value), they will sell the security, resulting in a price drop. The speed with which financial security prices adjust to unexpected news, so as to maintain equality with the fair present value of the security, is referred to as **market efficiency.** We examine the three forms of market efficiency (weak form, semistrong form, and strong form) in Chapter 9.

market efficiency

The process by which financial security prices move to a new equilibrium when interest rates or a security-specific characteristic changes.

Realized Rate of Return

Required and expected rates of return are interest return concepts pertaining to the returns expected or required just prior to the investment being made. Once made, however, the market participant is concerned with how well the financial security actually performs. The **realized rate of return** (rr) on a financial security is the interest rate *actually* earned on an investment in a financial security. The realized rate of return is thus a historical interest rate of return—it is an ex post (after the fact) measure of the interest rate on the security.

realized rate of return

The actual interest rate earned on an investment in a financial security.

To calculate a realized rate of return (rr), all cash flows actually paid or received are incorporated in time value of money equations to solve for the realized rate of return. By setting the price actually paid for the security (P) equal to the present value of the realized cash flows ($RCF_1, RCF_2, \ldots, RCF_n$), the realized rate of return is the discount rate that just equates the purchase price to the present value of the realized cash flows. That is:

DO YOU UNDERSTAND?

$$P = \frac{RCF_1}{(1+rr)^1} + \frac{RCF_2}{(1+rr)^2} + \cdots + \frac{RCF_n}{(1+rr)^n}$$

where

RCF_t = Realized cash flow in period t ($t = 1, \ldots, n$)
rr = Realized rate of return on a security

If the realized rate of return (rr) is greater than the required rate of return (rrr), the market participant actually earned more than was needed to be compensated for the ex ante or expected risk of investing in the security. If the realized rate of return is less than the required rate of return, the market participant actually earned less than the interest rate required to compensate for the risk involved.

EXAMPLE 3–3 Application of Realized Rate of Return

Consider again the bond investment described in Examples 3–1 and 3–2. Using your original purchase price, $890, and the current market price on this bond, the realized rate of return you have earned on this bond over the last two years is calculated as follows:

$$890 = \frac{100}{(1+rr)^1} + \frac{100+925}{(1+rr)^2}$$

$$\Rightarrow rr = 13.08\%$$

BOND VALUATION

The valuation of a bond instrument employs time value of money concepts. The fair value of a bond reflects the present value of all cash flows promised or projected to be received on that bond discounted at the required rate of return (*rrr*). Similarly, the expected rate of return (*Err*) is the interest rate that equates the current market price of the bond with the present value of all promised cash flows received over the life of the bond. Finally, a realized rate of return (*rr*) on a bond is the actual return earned on a bond investment that has already taken place. We again will limit our present discussion of bond valuation to required and expected rates of return. Appendix 3A to this chapter, found on the book's Web site (**www.mhhe.com/sc3e**), reviews the valuation of equity instruments (such as common stock). Promised cash flows on bonds come from two sources: (1) interest or coupon payments paid over the life of the bond and (2) a lump sum payment (face or par value) when a bond matures.

coupon bonds

Bonds that pay interest based on a stated coupon rate. The interest paid or coupon payments per year is generally constant over the life of the bond.

zero-coupon bonds

Bonds that do not pay interest.

2 Bond Valuation Formula Used to Calculate Fair Present Values

Most bonds pay a stated coupon rate of interest to the holders of the bonds. These bonds are called **coupon bonds.** The interest, or coupon, payments per year, INT, are generally constant (are fixed) over the life of the bond.[5] Thus, the fixed interest payment is essentially an annuity paid to the bond holder periodically (normally semiannually) over the life of the bond. Bonds that do not pay coupon interest are called **zero-coupon bonds.** For these bonds, INT is zero. The face or par value of the bond, on the other hand, is a lump sum payment received by the bond holder when the bond matures. Face value is generally set at $1,000 in the U.S. bond market.

Using time value of money formulas, and assuming that the bond issuer makes its promised semiannual coupon and principal payments, the present value of the bond can be written as:[6]

$$V_b = \frac{INT/2}{(1 + i_d/2)^1} + \frac{INT/2}{(1 + i_d/2)^2} + \cdots + \frac{INT/2}{(1 + i_d/2)^{2N}} + \frac{M}{(1 + i_d/2)^{2N}}$$

$$= \frac{INT}{2} \sum_{t=1}^{2N} \left(\frac{1}{1 + i_d/2} \right)^t + \frac{M}{(1 + i_d/2)^{2N}}$$

$$= \frac{INT}{(2)} (PVIFA_{i_d/2,2N}) + M(PFIV_{i_d/2,2N})$$

where

V_b = Present value of the bond
M = Par or face value of the bond
INT = Annual interest (or coupon) payment per year on the bond; equals the par value of the bond times the (percentage) coupon rate
N = Number of years until the bond matures
i_d = Annual interest rate used to discount cash flows on the bond
$PVIF$ = Present value interest factor of a lump sum payment
$PVIFA$ = Present value interest factor of an annuity stream

5. Variable rate bonds pay interest that is indexed to some broad interest rate measure (such as Treasury bill rates) and thus experience variable coupon payments. Income bonds pay interest only if the issuer has sufficient earnings to make the promised payments. Index (or purchasing power) bonds pay interest based on an inflation index. Both these types of bonds, therefore, can have variable interest payments.

6. More generally for bonds that pay interest other than semiannually:

$$V_b = \frac{INT}{m} (PVIFA_{i_d/m,Nm}) + M(PVIF_{i_d/m,Nm})$$

where m = Number of times per year interest is paid.

EXAMPLE 3-4 Calculation of the Fair Value of a Coupon Bond

You are considering the purchase of a $1,000 face value bond that pays 10 percent coupon interest per year, with the coupon paid semiannually (i.e., $50 (=1,000(.1)/2) over the first half of the year and $50 over the second half of the year). The bond matures in 12 years (i.e., the bond pays interest (12 × 2 =) 24 times before it matures). If the required rate of return (*rrr*) on this bond is 8 percent (i.e., the periodic discount rate is (8%/2 =) 4 percent), the fair market value of the bond is calculated as follows:

$$V_b = \frac{1{,}000(.1)}{2}(PVIFA_{8\%/2,12(2)}) + 1{,}000(PVIF_{8\%/2,12(2)})$$
$$= 50(15.24696) + 1{,}000(.39012) = \$1{,}152.47$$

or an investor would be willing to pay no more than $1,152.47 for this bond.[7,8]

If the required rate of return on this bond is 10 percent, the fair market value of the bond is calculated as follows:

$$V_b = \frac{1{,}000(.1)}{2}(PVIFA_{10\%/2.12(2)}) + 1{,}000(PVIF_{10\%/2,12(2)})$$
$$= 50(13.79864) + 1{,}000(.31007) = \$1{,}000.00$$

or an investor would be willing to pay no more than $1,000.00 for this bond.

If the required rate of return on this bond is 12 percent, the fair market value of the bond is calculated as follows:

$$V_b = \frac{1{,}000(.1)}{2}(PVIFA_{12\%/2,12(2)}) + 1{,}000(PVIF_{12\%/2,12(2)})$$
$$= 50(12.55036) + 1{,}000(.24698) = \$874.50$$

or an investor would be willing to pay no more than $874.50 for this bond.

premium bond

A bond in which the present value of the bond is greater than its face value.

discount bond

A bond in which the present value of the bond is less than its face value.

In the preceding example, notice that when the required rate of return (rrr) on the bond is 8 percent, the fair value of the bond, $1,152.47, is greater than its face value of $1,000. When this relationship between the fair value and the face value of a bond exists, the bond is referred to as a **bond** that should sell at a **premium.** This premium occurs because the coupon rate on the bond is greater than the required rate of return on the bond (a 10 percent coupon rate versus an 8 percent required rate of return in our example). When the required rate of return on the bond is 12 percent, the present value of the bond is less than its face value, and the bond is referred to as a **bond** that should sell at a **discount.** This discount occurs because the coupon rate on the bond is less than the required rate of return on the bond.

7. If the bond paid interest once per year (i.e., $m = 1$) rather than twice, the bond's fair market value is calculated as:

$$V_b = 1{,}000(.1)(PVIFA_{8\%,12}) + 1{,}000(PVIF_{8\%,12}) = \$1{,}150.72.$$

8. These pricing formulas are programmed in business calculators. Because there are several variations of business calculators, we do not apply the problems in the text to any one brand of calculator.

TABLE 3–3 Description of a Premium, Discount, and Par Bond

Premium Bond—when the *coupon rate* on a bond is greater than the *required rate of return* on the bond, the *fair present value* is greater than the *face value* of the bond.
When the *coupon rate* on a bond is greater than the *yield to maturity* on the bond, the *current market price* is greater than the *face value* of the bond.

Discount Bond—when the *coupon rate* on a bond is less than the *required rate of return* on the bond, the *fair present value* is less than the *face value* of the bond.
When the *coupon rate* on a bond is less than the *yield to maturity* on the bond, the *current market price* is less than the *face value* of the bond.

Par Value—when the *coupon rate* on a bond is equal to the *required rate of return* on the bond, the *fair present value* is equal to the *face value* of the bond.
When the *coupon rate* on a bond is equal to the *yield to maturity* on the bond, the *current market price* is equal to the *face value* of the bond.

par bond
A bond in which the present value of the bond is equal to its face value.

Finally, when the required rate of return on the bond is 10 percent, the present value of the bond is equal to its face value, and the bond is referred to as a **bond** that should sell at **par.** This par occurs because the coupon rate on the bond is equal to the required rate of return on the bond. To achieve the required rate of return on the bond, the bond holder experiences neither a gain nor a loss on the difference between the purchase price of the bond and the face value received at maturity. We summarize the scenarios for premium, discount,[9] and par bonds in Table 3–3.

It should be noted that the designation as a premium, discount, or par bond does not necessarily assist a bond holder in the decision to buy or sell a bond. This decision is made on the basis of the relationship between the fair present value and the actual current market price of the bond. Rather, premium, discount, and par bonds are descriptive designations regarding the relationship between the fair present value of the bond and its face value. As stated above, the fair present value of the bond will equal the bond's price only in an efficient market where prices instantaneously adjust to new information about the security's value.

Bond Valuation Formula Used to Calculate Yield to Maturity

yield to maturity
The return or yield the bond holder will earn on the bond if he or she buys it at its current market price, receives all coupon and principal payments as promised, and holds the bond until maturity.

The present value formulas can also be used to find the expected rate of return (*Err*) or, assuming all promised coupon and principal payments are made with a probability of 100 percent, what is often called the **yield to maturity** (ytm) on a bond (i.e., the return the bond holder would earn on the bond if he or she buys the bond at its current market price, receives all coupon and principal payments as promised, and holds the bond until maturity). The yield to maturity calculation implicitly assumes that all coupon payments periodically received by the bond holder can be reinvested at the same rate—that is, reinvested at the calculated yield to maturity.[10]

Rewriting the bond valuation formula, where V_b is the current market price that has to be paid to buy the bond, we can solve for the yield to maturity (*ytm*) on a bond as follows (where we write *ytm* instead of *Err*):

$$V_b = \frac{INT/2}{(1 + ytm/2)^1} + \frac{INT/2}{(1 + ytm/2)^2} + \cdots + \frac{INT/2}{(1 + ytm/2)^{2N}} + \frac{M}{(1 + ytm/2)^{2N}}$$

$$= \frac{INT}{2}(PVIFA_{ytm/2,2N}) + M(PVIF_{ytm/2,2N})$$

9. The term discount bond is also used to denote a zero-coupon bond.

10. As discussed in Appendix 3B to this chapter (located at the book's Web site, **www.mhhe.com/sc3e**), if coupon payments are reinvested at less (more) than this rate, the yield to maturity will be lower (higher) than that calculated in this section. This concept will be key to understanding interest rate risk discussed later in the text (Chapters 22 and 23).

TABLE 3–4 Summary of Factors that Affect Security Prices and Price Volatility When Interest Rates Change

Interest Rate—there is a negative relation between interest rate changes and present value (or price) changes on financial securities.

As interest rates increase, security prices decrease at a decreasing rate.

Time Remaining to Maturity—the shorter the time to maturity for a security, the closer the price is to the face value of the security.

The longer the time to maturity for a security, the larger the price change of the security for a given interest rate change.

The maturity effect described above increases at a decreasing rate.

Coupon Rate—the higher a security's coupon rate, the smaller the price change on the security for a given change in interest rates.

EXAMPLE 3–5 Calculation of the Yield to Maturity on a Coupon Bond

You are considering the purchase of a $1,000 face value bond that pays 11 percent coupon interest per year, paid semiannually (i.e., $550 (= $1,000(.11)/2) per semiannual period). The bond matures in 15 years and has a face value of $1,000. If the current market price of the bond is $931.176, the yield to maturity (or *Err*) is calculated as follows:

$$931.176 = \frac{1{,}000(.11)}{2}(PVIFA_{ytm/2,15(2)}) + 1{,}000(PVIF_{ytm/2,15(2)})$$

Solving for *ytm*,[11] the yield to maturity (or expected rate of return) on the bond is 12 percent.[12] Equivalently, you would be willing to buy the bond only if the required rate of return (*rrr*) was no more than 12 percent.

DO YOU UNDERSTAND?

As already discussed in this chapter and in Chapter 2, the variability of financial security prices depends on interest rates and the characteristics of the security. Specifically, the factors that affect financial security prices include interest rate changes, the time remaining to maturity, and the coupon rate. We evaluate next the impact of each of these factors as they affect bond prices. Table 3–4 summarizes the major relationships we will be discussing.

IMPACT OF INTEREST RATE CHANGES ON SECURITY VALUES

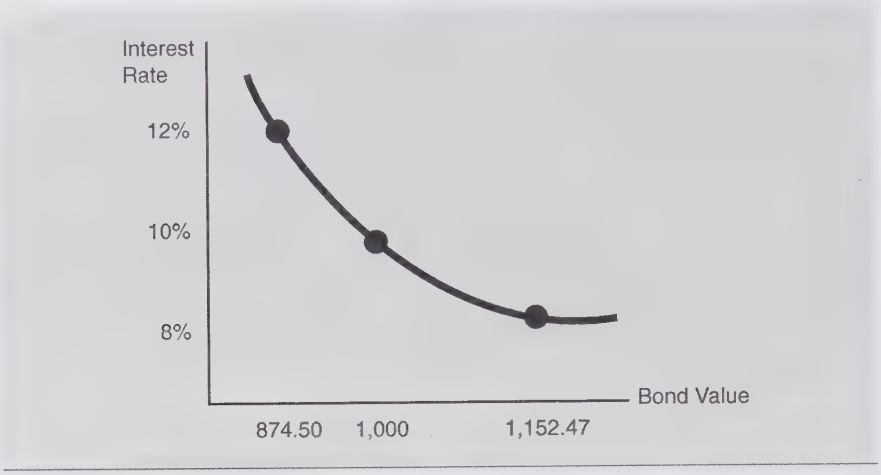
Refer back to Example 3–4. Notice in this example that present values of the cash flows on bonds decreased as interest rates increased. Specifically, when the required rate of return increased from 8 percent to 10 percent, the fair present value of the bond fell from $1,152.47 to $1,000, or by 13.23 percent ((1,000 − 1,152.47)/1,152.47). Similarly, when the required rate of return increased from 10 percent to 12 percent, the fair present value of the bond fell from $1,000 to $874.50, or by 12.55 percent ((874.50 − 1,000)/1,000). This is the inverse relationship between present values

11. Business calculators are programmed to easily solve for the yield to maturity on a security.

12. The yield to maturity is the nominal return on the bond. Its effective annual return is calculated as (see Chapter 2):

$$EAR = (1 + ytm/2)^2 - 1 = (1 + .12/2)^2 - 1 = 12.36\%$$

FIGURE 3–1 Relation between Interest Rates and Bond Values



and interest rates we discussed in Chapter 2. While the examples refer to the relation between fair values and required rates of returns, the inverse relation also exists between current market prices and expected rates of return—as yields on bonds increase, the current market prices of bonds decrease. We illustrate this inverse relation between interest rates on bonds and the present value of bonds in Figure 3–1.

Notice too from the earlier example that the inverse relationship between bond prices and interest rates is not linear. Rather, the percentage change in the present value of a bond to a given change in interest rates is smaller when interest rates are higher. When the required rate of return on the bond increased from 8 percent to 10 percent (a 2 percent increase), the fair present value on the bond decreased by 13.23 percent. However, another 2 percent increase in the required rate of return (from 10 percent to 12 percent) resulted in a fair present value decrease of only 12.55 percent. The same nonlinear relation exists for current market prices and yield to maturities. Thus, as interest rates increase, present values of bonds (and bond prices) decrease at a decreasing rate. This is illustrated in Figure 3–1.

The relationship between interest rates and security values is important for all types of investors. Financial institutions (FIs) such as commercial banks, thrifts, and insurance companies are affected because the vast majority of the assets and liabilities held by these firms are financial securities (e.g., loans, deposits, investment securities). When required rates of return rise (fall) on these securities, the fair present values of the FI's asset and liability portfolios decrease (increase) by possibly different amounts, which in turn affects the fair present value of the FI's equity (the difference between the fair present value of an FI's assets and liabilities).

For example, suppose an FI held the 8 percent required return bond evaluated in Example 3–4 (10 percent coupon interest per year paid semiannually, 12 years remaining to maturity, and face value of $1,000) in its asset portfolio and had partly financed the asset purchase by issuing the 10 percent required return bond evaluated in Example 3–4 (the same bond characteristics as above except that the required rate of return is 10 percent) as part of its liability portfolio. In the example, we calculated the fair present values of these bonds as $1,152.47 and $1,000, respectively. The market value balance sheet of the FI is shown in Table 3–5. The market value of the FI's equity is $152.47 ($1,152.47 − $1,000)—the difference between the market values of the FI's assets and liabilities. This can also be thought of as the value of the FI's equity owners' contribution to the financing of the purchase of the asset. If the required rate of return increases by 2 percent on both of these bonds (to 10 percent on the bond in the asset portfolio and to 12 percent on the bond in the liability portfolio),

DO YOU UNDERSTAND?

1. What happens to the fair present value of a bond when the required rate of return increases?

TABLE 3–5 Balance Sheet of an FI before and after an Interest Rate Increase

(a) Balance Sheet before the Interest Rate Increase

Assets		Liabilities and Equity	
Bond (8% required rate of return)	$1,152.47	Bond (10% required rate of return)	$1,000
		Equity	$152.47

(b) Balance Sheet after 2 Percent Increase in the Interest Rates

Assets		Liabilities and Equity	
Bond (10% required rate of return)	$1,000	Bond (12% required rate of return)	$874.50
		Equity	$125.50

the fair present values of the asset and liability portfolios fall to $1,000 and $874.50, respectively. As a result, the value of the FI's equity falls to $125.50 ($1,000 − $874.50)—see Table 3–5. Implicitly, the equity owners of the FI have lost $26.97 ($152.47 − $125.50) of the value of their ownership stake in the FI. We examine the measurement and management of an FI's interest rate risk in more detail in Chapter 22.

In this section we presented an example in which a change in interest rates results in a decrease in an FI's asset and liability values, and thus equity value. In the next two sections we look at how the maturity of, and coupon rate on, a security affects the size of the value changes for a given change in interest rates.

4 IMPACT OF MATURITY ON SECURITY VALUES

price sensitivity
The percentage change in a bond's present value for a given change in interest rates.

An important factor that affects the degree to which the price of a bond changes (or the price sensitivity of a bond changes) as interest rates change is the time remaining to maturity on the bond. A bond's **price sensitivity** is measured by the percentage change in its present value for a given change in interest rates. The larger the percentage change in the bond's value for a given interest rate change, the larger the bond's price sensitivity. Specifically, as is explained below, the shorter the time remaining to maturity, the closer a bond's price is to its face value. Also, the further a bond is from maturity, the more sensitive the price (fair or current) of the bond as interest rates change. Finally, the relationship between bond price sensitivity and maturity is not linear. As the time remaining to maturity on a bond increases, price sensitivity increases but at a decreasing rate. Table 3–6 presents the bond information we will be using to illustrate these relationships.

Maturity and Security Prices

Table 3–6 lists the present values of 10 percent (compounded semiannually) coupon bonds with a $1,000 face value and 12 years, 14 years, and 16 years, respectively, remaining to maturity. We calculate the fair present value of these bonds using an 8 percent, 10 percent, and 12 percent required rate of return. Notice that for each of these bonds, the closer the bond is to maturity, the closer the fair present value of the bond is to the $1,000 face value. This is true regardless of whether the bond is a premium, discount, or par bond. For example, at an 8 percent interest rate, the 12-year, 14-year, and 16-year bonds have present

TABLE 3–6 The Impact of Time to Maturity on the Relation between a Bond's Fair Present Value and Its Required Rate of Return

	12 Years to Maturity			14 Years to Maturity			16 Years to Maturity		
Required Rate of Return	Fair Price*	Price Change	Percentage Price Change	Fair Price*	Price Change	Percentage Price Change	Fair Price*	Price Change	Percentage Price Change
8%	$1,152.47			$1,166.63			$1,178.74		
		−$152.47	−13.23%		−$166.63	−14.28%		−$178.74	−15.16%
10%	1,000.00			1,000.00			1,000.00		
		−125.50	−12.55		−134.06	−13.41		−140.84	−14.08
12%	874.50			865.94			859.16		

*The bond pays 10% coupon interest compounded semiannually and has a face value of $1,000.

values of $1,152.47, $1,166.63, and $1,178.74, respectively. The intuition behind this is that nobody would pay much more than the face value of the bond and any remaining (in this case semiannual) coupon payments just prior to maturity since these are the only cash flows left to be paid on the bond. Thus, the time value effect is reduced as the maturity of the bond approaches. Many people call this effect the pull to par—bond prices and fair values approach their par values (e.g., $1,000) as time to maturity declines towards zero.

Maturity and Security Price Sensitivity to Changes in Interest Rates

The Percentage Price Change columns in Table 3–6 provide data to examine the effect time to maturity has on bond price sensitivity to interest rates change. From these data we see that the longer the time remaining to maturity on a bond, the more sensitive are bond prices to a given change in interest rates. (Note again that all bonds in Table 3–6 have a 10 percent coupon rate and a $1,000 face value.) For example, the fair present value of the 12-year bond falls 13.23 percent (i.e., ($1,000 − $1,152.47)/$1,152.47 = −.1323 = −13.23%) as the required rate of return increases from 8 percent to 10 percent. The same 2 percent increase (from 8 percent to 10 percent) in the required rate of return produces a larger 14.28 percent drop in the fair present value of the 14-year bond, and the 16-year bond's fair present value drops 15.16 percent. This same trend is demonstrated when the required rate of return increases from 10 percent to 12 percent—the longer the bond's maturity, the greater the percentage decrease in the bond's fair present value.

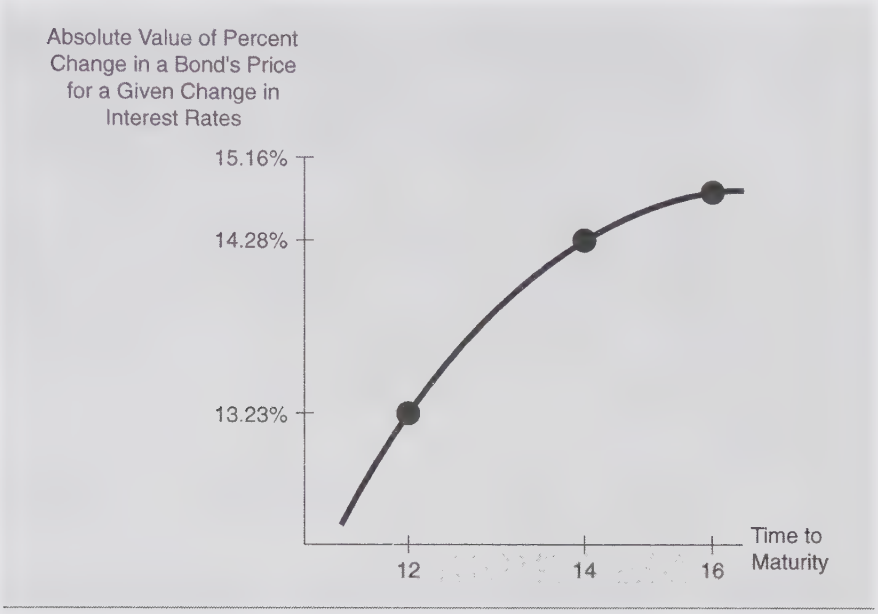
The same relationship occurs when analyzing expected rates of return (or yields to maturity) and the current market price of the bond—the longer the time to maturity on a bond, the larger the change in the current market price of a bond for a given change in yield to maturity.

Incremental Changes in Maturity and Security Price Sensitivity to Changes in Interest Rates. A final relationship we can examine from Table 3–6 is that between incremental changes in time remaining to maturity and incremental changes in security price sensitivity to a given change in interest rates. Specifically, notice that the maturity effect described above is not linear. For example, a 2 percent increase in the required rate of return (from 8 percent to 10 percent) on the 12-year bond produces a 13.23 percent (i.e., ($1,000 − $1,152.47)/$1,152.47 = −.1323 = −13.23%) decrease in the bond's fair present value. The same 2 percent increase (from 8 percent to 10 percent) in the 14-year bond produces a 14.28 percent decrease in the fair present value. The difference, as we move from a 12-year to a 14-year maturity, is 1.05 percent (14.28% − 13.23%). Increasing the time to maturity two more years

DO YOU UNDERSTAND?

1. What happens to a bond's price
2. Why is it [illegible]

FIGURE 3–2 **The Impact of a Bond's Maturity on Its Interest Rate Sensitivity**



(from 14 years to 16 years) produces an increase in price sensitivity of .88 percent (−14.28% − (−15.16%)). While price sensitivity for a given increase in interest rates increases with maturity, the increase is nonlinear (decreasing) in maturity. We illustrate this relationship in Figure 3–2, as the required rate of return increases from 8 percent to 10 percent.

4 IMPACT OF COUPON RATES ON SECURITY VALUES

Another factor that affects the degree to which the price sensitivity of a bond changes as interest rates change is the bond's coupon rate. Specifically, the higher the bond's coupon rate, the higher its present value at any given interest rate. Also, the higher the bond's coupon rate, the smaller the price changes on the bond for a given change in interest rates. These relationships hold when evaluating either required rates of return and the resulting fair present value of the bond or expected rates of return and the current market price of the bond. To understand these relationships better, consider again the bonds in Example 3–4. Table 3–7 summarizes the bond values and value changes as interest rates change.

Coupon Rate and Security Price

In Table 3–7, we first list the fair present values of the bonds analyzed in Example 3–4. We then repeat the present value calculations using two bonds with identical characteristics except for the coupon rate: 10 percent versus 12 percent. Notice that the fair present value of the 10 percent coupon bond is lower than that of the 12 percent coupon bond at every required rate of return. For example, when the required rate of return is 8 percent, the fair value of the 10 percent coupon bond is $1,152.47 and that of the 12 percent coupon bond is $1,304.94.

Coupon Rate and Security Price Sensitivity to Changes in Interest Rates

Table 3–7 also demonstrates the effect a bond's coupon rate has on its price sensitivity to a given change in interest rates. The intuition behind this relation is as follows. The higher

TABLE 3–7 The Impact of Coupon Rate on the Relation between a Bond's Fair Present Value and Its Required Rate of Return

	10 Percent Coupon Bond			12 Percent Coupon Bond		
Required Rate of Return	Fair Price*	Price Change	Percentage Price Change	Fair Price*	Price Change	Percentage Price Change
8%	$1,152.47			$1,304.94		
		−$152.47	−13.23%		−$166.95	−12.79%
10%	1,000.00			1,137.99		
		−125.50	−12.55		−137.99	−12.13
12%	874.50			1,000.00		

*The bond pays interest semiannually, has 12 years remaining to maturity, and has a face value of $1,000.

(lower) the coupon rate on the bond, the larger (smaller) is the portion of the required rate of return paid to the bond holder in the form of coupon payments. Any security that returns a greater (smaller) proportion of an investment sooner is more (less) valuable and less (more) price volatile.

To see this, notice in Table 3–7 that the higher the bond's coupon rate, the smaller the bond's price sensitivity for any given change in interest rates. For example, for the 10 percent coupon bond, a 2 percent increase in the required rate of return (from 8 percent to 10 percent) results in a 13.23 percent decrease in the bond's fair price. A further 2 percent increase in the required rate of return (from 10 percent to 12 percent) results in a smaller 12.55 percent decrease in the fair price.

For the 12 percent coupon bond, notice that the 2 percent increase in the required rate of return (from 8 percent to 10 percent) results in a 12.79 percent decrease in the bond's fair price, while an increase in the required rate of return from 10 percent to 12 percent results in a lower 12.13 percent decrease in the bond's fair price. Thus, price sensitivity on a bond is negatively related to the level of the coupon rate on a bond. The higher the coupon rate on the bond, the smaller the decrease in the bond's fair price for a given increase in the required rate of return on the bond.

DO YOU UNDERSTAND?

1. Whether a high or low coupon

We illustrate this relationship in Figure 3–3. The high coupon-paying bond is less susceptible to interest rate changes than the low coupon-paying bond. This is represented in Figure 3–3 by the slope of the line representing the relation between interest rates and bond prices. The sensitivity of bond prices is smaller (the slope of the line is flatter) for high-coupon bonds than for low-coupon bonds.

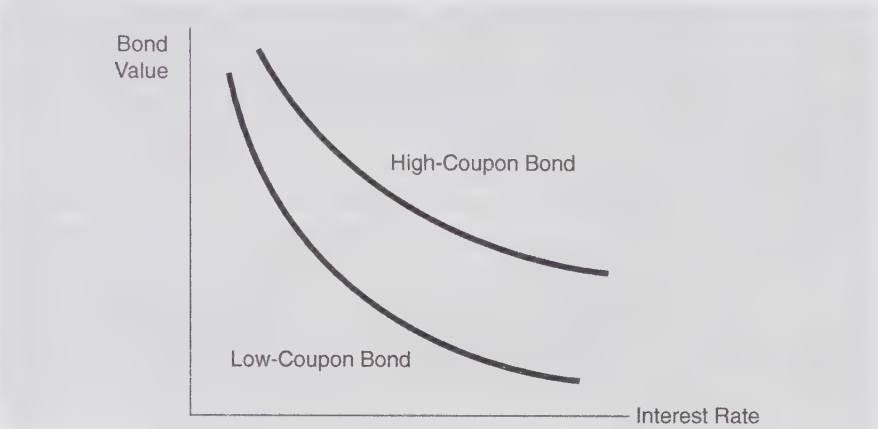
5 DURATION

In this section, we show that the price sensitivity of a bond, or the percent change in the bond's fair present value, for a given change in interest rates (as discussed above) can be more directly measured by a concept called duration (or Macauley's duration). We also show that duration produces an accurate measure of the price sensitivity of a bond to interest rate changes for relatively small changes in interest rates. The duration measure is a less accurate measure of price sensitivity the larger the change in interest rates. **Duration** is the *weighted-average* time to maturity on a financial security using the relative present values of the cash flows as weights. On a time value of money basis, duration measures the period of time required to recover the initial investment in a bond. Any cash flows received prior to the period of a bond's duration reflect the recovery of the initial investment, while cash flows received after the period of a bond's measured duration and before its maturity are the profits or returns earned by the investor. In addition

duration

The weighted-average time to maturity on an investment.

FIGURE 3–3 The Impact of a Bond's Coupon Rate on Its Interest Rate Sensitivity



elasticity

The percentage change in the price of a bond for a given change in interest rates.

to being a measure of the average life of an asset or liability, duration also has *economic* meaning as the sensitivity, or **elasticity,** of that asset's or liability's value to small interest rate changes (either required rate of return or yield to maturity).[13] Duration describes the percentage price, or present value, change of a financial security for a given (small) change in interest rates. Thus, rather than calculating present value changes resulting from interest rate changes, as we did in the previous sections, the duration of a financial security can be used to directly calculate the price change.

In this section, we present the basic arithmetic needed to calculate the duration of an asset or liability. Then we analyze the economic meaning of the number we calculate for duration and explain why duration, as a measure of interest rate sensitivity, is most accurate only for small changes in interest rates. Appendix 3B to this chapter located at the book's Web site (**www.mhhe.com/sc3e**), looks at how duration can be used to immunize an asset or liability against interest rate risk.

A Simple Illustration of Duration

Duration is a measure that incorporates the time of arrival of all cash flows on an asset or liability along with the asset or liability's maturity date. To see this, consider a bond with one year remaining to maturity, a $1,000 face value, an 8 percent coupon rate (paid semiannually), and an interest rate (either required rate of return or yield to maturity) of 10 percent. The promised cash flows from this bond are illustrated in Figure 3–4. The bond holder receives the promised cash flows (CF) from the bond issuer at the end of one half year and at the end of one year.

$CF_{1/2}$ is the $40 promised payment of (semiannual) coupon interest ($\$1{,}000 \times 8\% \times \frac{1}{2}$) received after six months. CF_1 is the promised cash flow at the end of year 1; it is equal to the second $40 promised (semiannual) coupon payment plus the $1,000 promised payment of face value. To compare the relative sizes of these two cash flow payments—since duration measures the weighted-average time to maturity of a bond—we should put them in the same dimensions, because $1 of principal or interest received at the end of one year is worth less to an investor in terms of time value of money than is $1 of principal or

13. In this sense, duration is to bonds what beta is to stocks. That is, beta is the change in the price of a security for a given change in the rate of return on a market portfolio. Thus, both duration and beta are measures of systematic risk.

FIGURE 3–4 Promised Cash Flows on the One-Year Bond

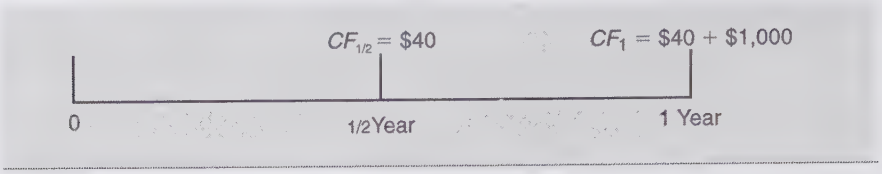
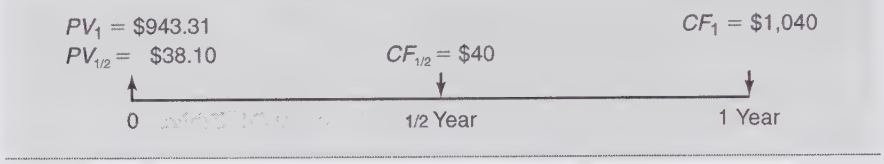


FIGURE 3–5 Present Value of the Cash Flows from the Bond



interest received at the end of six months. Assuming that the current interest rate is 10 percent per year, we calculate the present values (PV) of the two cash flows (CF) as:

$$CF_{1/2} = \$40 \qquad PV_{1/2} = \$40/(1.05) = \$38.10$$
$$CF_1 = \$1{,}040 \qquad PV_1 = \$1{,}040/(1.05)^2 = \$943.31$$
$$CF_{1/2} + CF_1 = \$1{,}080 \qquad PV_{1/2} + PV_1 = \$981.41$$

Note that since $CF_{1/2}$, the cash flows received at the end of one half year, are received earlier, they are discounted at $(1 + R/2)$ (where R is the current annual interest rate on the bond); this discount factor is smaller than the discount rate applied to the cash flow received at the end of the year $(1 + R/2)^2$. Figure 3–5 summarizes the PVs of the cash flows from the bond.[14]

The bond holder receives some cash flows at one half year and some at one year (see Figure 3–5). Intuitively, duration is the weighted-average maturity on the portfolio of zero-coupon bonds, one that has payments at one-half year and at the end of the year (year 1) in this example. Specifically, duration analysis weights the time at which cash flows are received by the relative importance in *present value terms* of the cash flows arriving at each point in time. In present value terms, the relative importance of the cash flows arriving at time $t = \frac{1}{2}$ year and time $t = 1$ year are as follows:

Time (t)	Weight (X)
½ year	$X_{1/2} = \dfrac{PV_{1/2}}{PV_{1/2} + PV_1} = \dfrac{38.10}{981.41} = .0388 = 3.88\%$
1 year	$X_1 = \dfrac{PV_1}{PV_{1/2} + PV_1} = \dfrac{943.31}{981.41} = \dfrac{.9612}{1.0} = \dfrac{96.12\%}{100\%}$

In present value terms, the bond holder receives 3.88 percent of the cash flows on the bond with the first coupon payment at the end of six months ($t_{1/2}$) and 96.12 percent with the second payment of coupon plus face value at the end of the year (t_1). By definition, the sum of the (present value) cash flow weights must equal 1:

$$X_{1/2} + X_1 = 1$$
$$.0388 + .9612 = 1$$

14. Here we use the Treasury formula for calculating the present values of cash flows on a security that pays cash flows semiannually. We use $1/(1 + \frac{1}{2}R)^2$ to discount the one-year cash flow rather than $1/(1 + R)$. This approach is more accurate, since it reflects the semiannual payment and compounding of interest on the bond.

We can now calculate the duration (D), or the weighted-average time to maturity of the bond, using the present value of its cash flows as weights:

$$D_L = X_{1/2} \times (t_{1/2}) + X_1 \times (t_1)$$
$$= .0388 \times (1/2) + .9612 \times (1) = .9806 \text{ years}$$

Thus, although the maturity of the bond is one year, its duration or average life in a cash flow sense is only .9806 years. On a time value of money basis, the initial investment in the bond is recovered after .9806 years. After that time, the investor earns a profit on the bond. Duration is less than maturity because in present value terms, 3.88 percent of the cash flows are received during the year.

A General Formula for Duration

You can calculate the duration for any fixed-income security that pays interest annually using the following formula:

$$D = \frac{\sum_{t=1}^{N} \frac{CF_t \times t}{(1+R)^t}}{\sum_{t=1}^{N} \frac{CF_t}{(1+R)^t}} = \frac{\sum_{t=1}^{N} PV_t \times t}{\sum_{t=1}^{N} PV_t}$$

where

D = Duration measured in years
t = 1 to N, the period in which a cash flow is received
N = Number of years to maturity
CF_t = Cash flow received on the security at end of period t
R = Yield to maturity (ytm) or current required market rate of return (rrr) on the investment
PV_t = Present value of the cash flow received at the end of the period t

For bonds that pay interest semiannually, the duration equation becomes:[15]

$$D = \frac{\sum_{t=1/2}^{N} \frac{CF_t \times t}{(1+R/2)^{2t}}}{\sum_{t=1/2}^{N} \frac{CF_t}{(1+R/2)^{2t}}}$$

where $t = 1/2, 1, 1\frac{1}{2}, \ldots, N$.

Notice that the denominator of the duration equation is the present value of the cash flows on the security (which in an efficient market will be equal to the current market price). The numerator is the present value of each cash flow received on the security multiplied or weighted by the length of time required to receive the cash flow. To help you fully understand this formula, we look at some examples next.

15. In general, the duration equation is written as:

$$D = \frac{\sum_{t=1/m}^{N} \frac{CF_t \times t}{(1+R/m)^{mt}}}{\sum_{t=1/m}^{N} \frac{CF_t}{(1+R/m)^{mt}}}$$

where m = number of times per year interest is paid.

EXAMPLE 3–6 The Duration of a Four-Year Bond

Suppose that you have a bond that offers a coupon rate of 10 percent paid semiannually (or 5 percent paid every 6 months). The face value of the bond is $1,000, it matures in four years, its current yield to maturity (R) is 8 percent, and its current price is $1,067.34. See Table 3–8 for the calculation of its duration. As the calculation indicates, the duration, or weighted-average time to maturity, on this bond is 3.42 years. In other words, on a time value of money basis, the initial investment of $1,067.34 is recovered after 3.42 years. Between 3.42 years and maturity (4 years), the bond produces a profit or return to the investor. Table 3–9 shows that if the annual coupon rate is lowered to 6 percent, the duration of the bond rises to 3.60 years. Since 6 percent annual coupon payments are smaller than 10 percent coupon payments, it takes longer to recover the initial investment with the 6 percent coupon bond. In Table 3–10, duration is calculated for the original 10 percent coupon bond, assuming that its yield to maturity (discount rate) increases from 8 percent to 10 percent. Now duration falls from 3.42 years (in Table 3–8) to 3.39 years. The higher the yield to maturity on the bond, the more the investor earns on reinvested coupons and the shorter the time needed to recover his or her initial investment. Finally, as the maturity on a bond decreases, in this case to 3 years in Table 3–11, duration falls to 2.67 years (i.e., the shorter the maturity on the bond, the more quickly the initial investment is recovered).

The Duration of a Zero-Coupon Bond. Zero-coupon bonds sell at a discount from face value on issue and pay their face value (e.g., $1,000) on maturity. These bonds have no intervening cash flows, such as coupon payments, between issue and maturity. The current price that an investor is willing to pay for such a bond, assuming semiannual compounding of interest, is equal to the present value of the single, fixed (face value) payment on the bond that is received on maturity (here, $1,000):

$$P = 1{,}000/(1 + R/2)^{2N}$$

where

R = Required semiannually compounded yield to maturity
N = Number of years to maturity
P = Price

TABLE 3–8 Duration of a Four-Year Bond with 10 Percent Coupon Paid Semiannually and 8 Percent Yield

t	CF_t	$\frac{1}{(1+4\%)^t}$	$\frac{CF_t}{(1+4\%)^t}$	$\frac{CF_t \times t}{(1+4\%)^t}$
½	50	0.9615	48.08	24.04
1	50	0.9246	46.23	46.23
1½	50	0.8890	44.45	66.67
2	50	0.8548	42.74	85.48
2½	50	0.8219	41.10	102.75
3	50	0.7903	39.52	118.56
3½	50	0.7599	38.00	133.00
4	1,050	0.7307	767.22	3,068.88
			1,067.34	3,645.61

$$D = \frac{3{,}645.61}{1{,}067.34} = 3.42 \text{ years}$$

TABLE 3–9 Duration of a Four-Year Bond with 6 Percent Coupon Paid Semiannually and 8 Percent Yield

t	CF_t	$\frac{1}{(1+\frac{0.08}{2})^t}$	$t \times PV(CF_t)$	$t(t+1) \times PV(CF_t)$
½	30	0.9615	28.84	14.42
1	30	0.9246	27.74	27.74
1½	30	0.8890	26.67	40.00
2	30	0.8548	25.64	51.28
2½	30	0.8219	24.66	61.65
3	30	0.7903	23.71	71.13
3½	30	0.7599	22.80	79.80
4	1,030	0.7307	752.62	3,010.48
			932.68	3,356.50

$$D = \frac{3{,}356.50}{932.68} = 3.60 \text{ years}$$

TABLE 3–10 Duration of a Four-Year Bond with 10 Percent Coupon Paid Semiannually and 10 Percent Yield

t	CF_t	$\frac{1}{(1+\frac{0.10}{2})^t}$	$t \times PV(CF_t)$	$t(t+1) \times PV(CF_t)$
½	50	0.9524	47.62	23.81
1	50	0.9070	45.35	45.35
1½	50	0.8638	43.19	64.78
2	50	0.8227	41.14	82.28
2½	50	0.7835	39.18	97.95
3	50	0.7462	37.31	111.93
3½	50	0.7107	35.53	124.36
4	1,050	0.6768	710.68	2,842.72
			1,000.00	3,393.18

$$D = \frac{3{,}393.18}{1{,}000.00} = 3.39 \text{ years}$$

TABLE 3–11 Duration of a Three-Year Bond with 10 Percent Coupon Paid Semiannually and 8 Percent Yield

t	CF_t	$\frac{1}{(1+\frac{0.08}{2})^t}$	$t \times PV(CF_t)$	$t(t+1) \times PV(CF_t)$
½	50	0.9615	48.08	24.04
1	50	0.9246	46.23	46.23
1½	50	0.8890	44.45	66.67
2	50	0.8548	42.74	85.48
2½	50	0.8219	41.10	102.75
3	1,050	0.7903	829.82	2,489.46
			1,052.42	2,814.63

$$D = \frac{2{,}814.63}{1{,}052.42} = 2.67 \text{ years}$$

Because the only cash flow received on these securities is the final payment at maturity (time N), the following must be true:

$$D_{zc} = N_{zc}$$

That is, the duration of a zero-coupon instrument equals its maturity. Note that it is only for zero-coupon bonds that duration and maturity are equal. Indeed, for any bond that pays some cash flows prior to maturity, its duration will always be less than its maturity.

EXAMPLE 3–7 The Duration of a Zero-Coupon Bond

Suppose that you have a zero-coupon bond with a face value of $1,000, a maturity of four years, and a current yield to maturity of 8 percent compounded semiannually. Since the bond pays no interest, the duration equation consists of only one term—cash flows at the end of year 4:

t	CF_4	$\frac{1}{(1+8\%/2)^{2\times4}}$	$\frac{CF_4}{(1+8\%/2)^{2\times4}}$	$\frac{CF_4\times4}{(1+4\%/2)^{2\times4}}$
4	$1,000	0.7307	730	2,923

$$D = 2{,}923/730 = 4 \text{ years}$$

or duration equals the maturity of the zero-coupon bond.

6 Features of Duration

The preceding examples suggest several important features of duration relating to the time remaining to maturity, yield to maturity, and coupon interest of the underlying bond being analyzed. These features are summarized in Table 3–12.

Duration and Coupon Interest. A comparison of Tables 3–8 and 3–9 indicates that the higher the coupon or promised interest payment on the bond, the lower its duration. This is due to the fact that the larger the coupon or promised interest payment, the more quickly investors receive cash flows on a bond and the higher are the present value weights of those cash flows in the duration calculation. On a time value of money basis, the investor recoups his or her initial investment faster when coupon payments are higher.

Duration and Yield to Maturity. A comparison of Tables 3–8 and 3–10 also indicates that duration decreases as yield to maturity increases. This makes intuitive sense since the higher the yield to maturity on the bond, the lower the present value cost of waiting to receive the later cash flows on the bond. Higher yields to maturity discount later cash flows more heavily, and the relative importance, or weights, of those later cash flows decline when compared to cash flows received earlier.

TABLE 3–12 Features of Duration

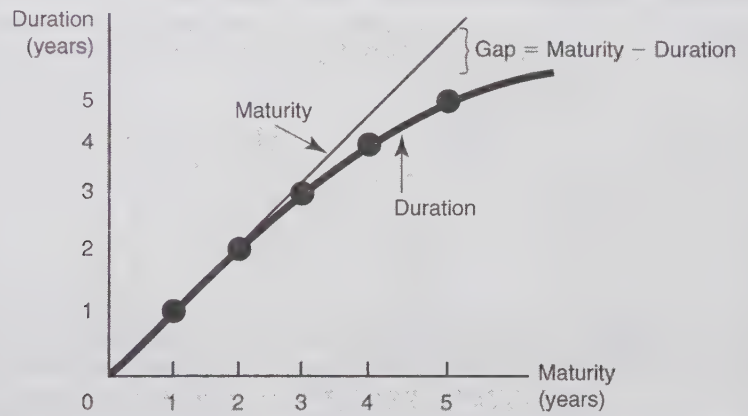
1. The higher the coupon or promised interest payment on a security, the lower is its duration.
2. The higher the yield on a security, the lower is its duration.
3. Duration increases with maturity at a decreasing rate.

TABLE 3–13 Duration of a Two-Year Bond with 10 Percent Coupon Paid Semiannually and 8 Percent Yield

½	50	0.9615	48.08	24.04
1	50	0.9246	46.23	46.23
1½	50	0.8890	44.45	66.67
2	1,050	0.8548	897.54	1,795.08
			1,036.30	1,932.02

$$D = \frac{1{,}932.02}{1{,}036.30} = 1.86 \text{ years}$$

FIGURE 3–6 Discrepancy between Maturity and Duration on a Coupon Bond



Duration and Maturity. A comparison of Tables 3–8, 3–11, and 3–13 indicates that duration increases with the maturity of a bond, but at a *decreasing* rate. As maturity of a 10 percent coupon bond decreases from four years to three years (Tables 3–8 and 3–11), duration decreases by 0.75 years, from 3.42 years to 2.67 years. Decreasing maturity for an additional year, from three years to two years (Tables 3–11 and 3–13), decreases duration by 0.81 years from 2.67 years to 1.86 years. Notice too that for a coupon bond, the longer the maturity on the bond the larger the discrepancy between maturity and duration. Specifically, the two-year maturity bond has a duration of 1.86 years (0.14 years less than its maturity), while the three-year maturity bond has a duration of 2.67 years (0.33 years less than its maturity), and the four-year maturity bond has a duration of 3.42 years (0.58 years less than its maturity). Figure 3–6 illustrates this relation between duration and maturity for our 10 percent coupon (paid semiannually), 8 percent yield bond.

Economic Meaning of Duration

So far we have calculated duration for a number of different bonds. In addition to being a measure of the average life of a bond, duration is also a direct measure of its interest rate sensitivity, or elasticity.[16] In other words, the larger the numerical

16. In Chapter 22, we also make the direct link between duration and the interest rate sensitivity of an asset or liability or of an FI's entire portfolio (i.e., its duration gap). We show how duration can be used to immunize a security or portfolio of securities against interest rate risk.

value of duration (D), the more sensitive the price of that bond to (small) changes or shocks in interest rates. The specific relationship between these factors for securities with annual compounding of interest is represented as:[17]

$$\frac{\Delta P/P}{\Delta R/(1+R)} = -D$$

For securities with semiannual receipt (compounding) of interest, it is represented as:

$$\frac{\Delta P/P}{\Delta R/(1+R/2)} = -D$$

The economic interpretation of this equation is that the number D is the interest elasticity, or sensitivity, of the bond's price to small interest rate (either required rate of return or yield to maturity) changes. The negative sign in front of the D indicates the inverse relationship between interest rate changes and price changes. That is, $-D$ describes the percentage fair or current value *decrease*—capital loss—on the security ($\Delta P/P$) for any given (discounted) small *increase* in interest rates ($\Delta R/(1+R)$), where ΔR is the change in interest rates and $1+R$ is one plus the *current* (or beginning) level of interest rates.

The definition of duration can be rearranged in another useful way for interpretation regarding interest sensitivity:

$$\frac{\Delta P}{P} = -D\left[\frac{\Delta R}{1+R}\right]$$

or

$$\frac{\Delta P}{P} = -D\left[\frac{\Delta R}{1+R/2}\right]$$

for annual and semiannual compounding of interest, respectively. This equation shows that for *small changes* in interest rates, bond prices move *in an inversely proportional* manner according to the size of D. Clearly, for any given change in interest rates, long duration securities suffer a larger capital loss (or receive a higher capital gain) should interest rates rise (fall) than do short duration securities.[18]

modified duration
Duration divided by 1 plus the interest rate.

The duration equation can be rearranged, combining D and $(1+R)$ into a single variable $D/(1+R)$, to produce what practitioners call **modified duration** (MD). For annual compounding of interest:

$$\frac{\Delta P}{P} = -MD \times \Delta R$$

where

$$MD = \frac{D}{1+R}$$

For semiannual compounding of interest:

$$\frac{\Delta P}{P} = -MD \times \Delta R$$

17. In what follows, we use the Δ (change) notation instead of d (derivative notation) to recognize that interest rate changes tend to be discrete rather then infinitesimally small. For example, in real-world financial markets the smallest observed rate change is usually one basis point, or 1/100 of 1 percent.

18. By implication, gains and losses under the duration model are *symmetric*. That is, if we repeated the above examples but allowed interest rates to decrease by one basis point annually (or ½ basis point semiannually), the percentage increase in the price of the bond ($\Delta P/P$) would be proportionate with D. Further, the capital gains would be a mirror image of the capital losses for an equal (small) decrease in interest rates.

where

$$MD = \frac{D}{1 + R/2}$$

This form is more intuitive because we multiply *MD* by the simple change in interest rates rather than the discounted change in interest rates as in the general duration equation. Next, we use duration to measure the price sensitivity of different bonds to small changes in interest rates.

The Interest-Paying Bond.

EXAMPLE 3–8 Four-Year Bond

Consider a four-year bond with a 10 percent coupon paid semiannually (or 5 percent paid every 6 months) and an 8 percent yield to maturity (the discount rate). According to calculations in Table 3–8, the bond's duration is $D = 3.42$ years. Suppose that the yield to maturity increases by 10 basis points (1/10 of 1 percent) from 8 to 8.10 percent; then, using the semiannual compounding version of the duration model shown above, the percentage change in the bond's price is:

$$\frac{\Delta P}{P} = -(3.42)\left[\frac{.001}{1.04}\right]$$
$$= -.00329$$

or

$$= -0.329\%$$

The bond price had been $1,067.34, which was the present value of a four-year bond with a 10 percent coupon and an 8 percent yield to maturity. However, the duration model predicts that the price of this bond would fall by 0.329 percent, or by $3.51, to $1,063.83 after the increase in the yield to maturity on the bond of 10 basis points.[19]

With a lower coupon rate of 6 percent, as shown in Table 3–9, the bond's duration, *D*, is 3.6 and the bond price changes by:

$$\frac{\Delta P}{P} = -(3.60)\left[\frac{.001}{1.04}\right] = -.00346$$

or

$$= -0.346\%$$

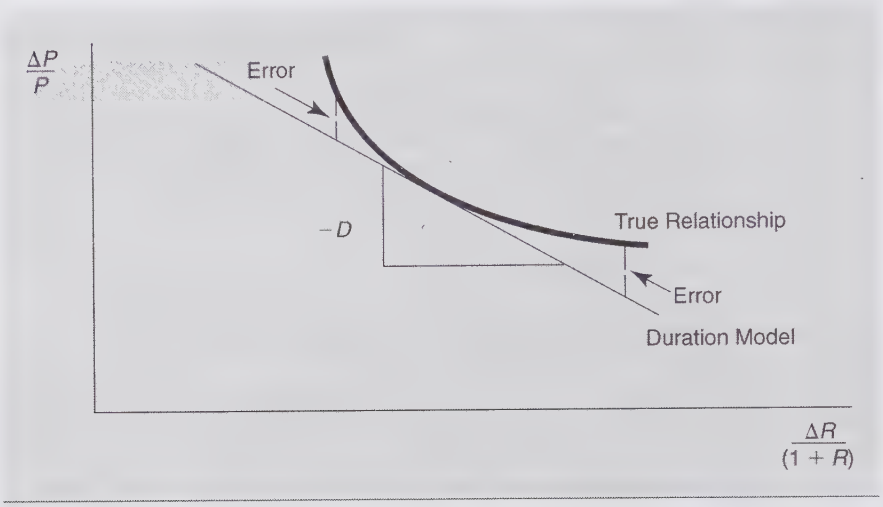
for a 10-basis-point increase in the yield to maturity for each semiannual period. The bond's price drops by 0.346 percent, or by $3.23, from $932.68 (reported in Table 3–9) to $929.45. Notice again that, all else held constant, the higher the coupon rate on the bond, the shorter the duration of the bond and the smaller the percentage decrease in a bond's price for a given increase in interest rates.

Large Interest Rate Changes and Duration

It needs to be stressed here that duration accurately measures the price sensitivity of financial securities only for *small* changes in interest rates of the order of one or a few basis points

19. That is, a price fall of 0.329 percent in this case translates into a dollar fall of $3.51. To calculate the dollar change in value, we can rewrite the equation as $\Delta P = (P)(-D)((\Delta R)/(1 + R/2)) = (\$1{,}067.34)(-3.42)(.001/1.04) = \$3.51$.

FIGURE 3–7 Duration Estimated versus True Bond Price



DO YOU UNDERSTAND?

1. When the duration of an asset is equal to its maturity?
2. When the denomination of the duration equation measures?
3. What the numerator of the duration equation measures?
4. What the duration of a zero-coupon bond is?
5. Which has the highest duration: a 20-year, 6 percent bond or a 20-year, zero-coupon bond, or a 5-year, 6 percent bond or a 10-year, 6 percent bond?

(a basis point is equal to one-hundredth of 1 percent). Suppose, however, that interest rate shocks are much larger, of the order of 2 percent or 200 basis points or more. While such large changes in interest rates are not common, this might happen in a financial crisis or if the central bank (see Chapter 4) suddenly changes its monetary policy strategy. In this case, duration becomes a less accurate predictor of how much the prices of bonds will change, and therefore, a less accurate measure of the price sensitivity of a bond to changes in interest rates. Figure 3–7 is a graphic representation of the reason for this. Note the difference in the change in a bond's price due to interest rate changes according to the proportional duration measure (D), and the "true relationship," using time value of money equations of Chapter 2 (and discussed earlier in this chapter) to calculate the exact present value change of a bond's price to interest rate changes.

Specifically, duration predicts that the relationship between an interest rate change and a security's price change will be proportional to the security's D (duration). By precisely calculating the exact or true change in the security's price, however, we would find that for large interest rate increases, duration overpredicts the *fall* in the security's price, and for large interest rate decreases, it underpredicts the *increase* in the security's price. Thus, duration misestimates the final value of a security following a large change (either positive or negative) in interest rates. Further, the duration model predicts symmetric effects for rate increases and decreases on a bond's price. As Figure 3–7 shows, in actuality, the *capital loss effect* of large rate increases tends to be smaller than the *capital gain effect* of large rate decreases. This is the result of a bond's price–interest rate relationship exhibiting a property called **convexity** rather than *linearity*, as assumed by the simple duration model. Intuitively, this is because the sensitivity of the bond's price to a change in interest rates depends on the *level* from which interest rates change (i.e., 6 percent, 8 percent, 10 percent, 12 percent). In particular, the higher the level of interest rates, the smaller a bond's price sensitivity to interest rate changes.

convexity
The degree of curvature of the price–interest rate curve around some interest rate level.

EXAMPLE 3–9 Calculation of the Change in a Security's Price Using the Duration versus the Time Value of Money Formula

To see the importance of accounting for the effects of convexity in assessing the impact of large interest rate changes, consider the four-year, $1,000 face value bond with a 10 percent

coupon paid semiannually and an 8 percent yield. In Table 3–8 we found this bond has a duration of 3.42 years, and its current price is $1,067.34 at a yield of 8 percent. We represent this as point *A* in Figure 3–8. If rates rise from 8 to 10 percent, the duration model predicts that the bond price will fall by 6.577 percent; that is:

$$\frac{\Delta P}{P} = -3.42(.02/1.04) = -6.577\%$$

or from a price of $1,067.34 to $997.14 (see point *B* in Figure 3–8). However, calculating the exact change in the bond's price after a rise in yield to 10 percent, we find its true value is:

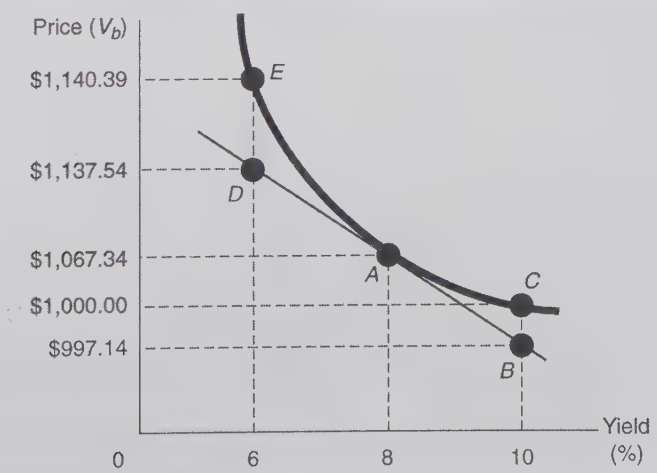
$$V_b = 50(PVIFA_{10\%/2,4(2)}) + 1{,}000(PVIFA_{10\%/2,4(2)}) = \$1{,}000$$

This is point *C* in Figure 3–8. As you can see, the true or actual fall in price is less than the predicted fall by $2.86. The reason for this is the natural convexity to the price-yield curve as yields rise.

Reversing the experiment reveals that the duration model would predict the bond's price to rise by 6.577 percent if yields fell from 8 to 6 percent, resulting in a predicted price of $1,137.54 (see point *D* in Figure 3–8). By comparison, the true or actual change in price can be computed as $1,140.39 by estimating the present value of the bond's coupons and its face value with a 6 percent yield (see point E in Figure 3–8). The duration model has underpredicted the bond price increase by $2.85 ($1,140.39 − $1,137.54).

An important question for managers of financial institutions and individual savers is whether the error in the duration equation is big enough to be concerned about. This depends on the size of the interest rate change and the size of the portfolio under management. Clearly, for a large portfolio the error will also be large.

FIGURE 3–8 Price–Yield Curve for the Four-Year 10 Percent Coupon Bond



Note that convexity is a desirable feature for an investor or FI manager to capture in a portfolio of assets. Buying a bond or a portfolio of assets that exhibits a lot of convexity or curvature in the price–yield curve relationship is similar to buying partial interest rate risk insurance. Specifically, high convexity means that for equally large changes of interest rates up and down (e.g., plus or minus 2 percent), the capital gain effect of a rate decrease more than offsets the capital loss effect of a rate increase.

So far, we have established the following three characteristics of convexity:

1. Convexity is desirable. The greater the convexity of a security or portfolio of securities, the more insurance or interest rate protection an investor or FI manager has against rate increases and the greater the potential gains after interest rate falls.
2. Convexity diminishes the error in duration as an investment criterion. The larger the interest rate changes and the more convex a fixed-income security or portfolio, the greater the error the investor or FI manager faces in using just duration (and duration matching) to immunize exposure to interest rate shocks.
3. All fixed-income securities are convex. The price of a bond can never be less than zero.

To illustrate the third characteristic, we can take the four-year, 10 percent coupon, 8 percent yield bond and look at two extreme price–yield scenarios. What is the price on the bond if yields fall to zero, and what is its price if yields rise to some very large number such as infinity? Where $R = 0$:

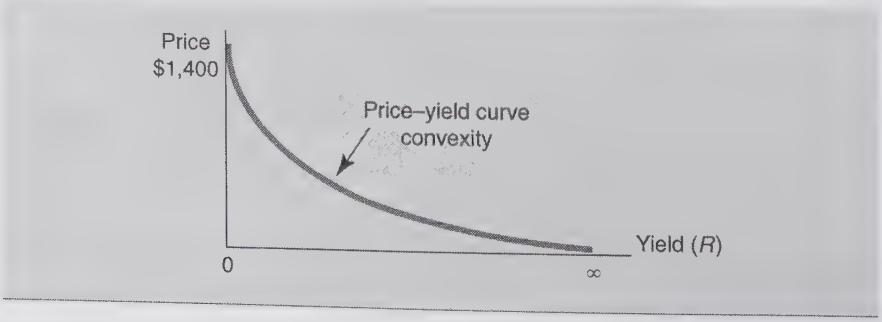
$$V_b = \frac{50}{(1+0)^1} + \frac{50}{(1+0)^2} + \cdots + \frac{1{,}050}{(1+0)^8} = \$1{,}400$$

The price is just the simple undiscounted sum of the coupon values and the face value of the bond. Since yields can never go below zero, $1,400 is the maximum possible price for the bond. Where $R = \infty$:

$$V_b = \frac{50}{(1+\infty)^1} + \frac{50}{(1+\infty)^2} + \cdots + \frac{1{,}050}{(1+\infty)^8} = \$0$$

As the yield goes to infinity, the bond price falls asymptotically toward zero, but by definition a bond's price can never be negative. Thus, zero must be the minimum bond price (see Figure 3–9). In Appendix 3C to this chapter, located at the book's Web site (**www.mhhe.com/sc3e**), we look at how to measure convexity and how this measure of convexity can be incorporated into the duration model to adjust for or offset the error in the prediction of security price changes for a given change in interest rates.

FIGURE 3–9 The Natural Convexity of Bonds



SUMMARY

This chapter applied the time value of money formulas presented in Chapter 2 to the valuation of financial securities such as equities and bonds. With respect to bonds, we included a detailed examination of how changes in interest rates, coupon rates, and time to maturity affect their price and price sensitivity. We also presented a measure of bond price sensitivity to interest rate changes, called duration. We showed how the value of duration is affected by various bond characteristics, such as coupon rates, interest rates, and time to maturity.

QUESTIONS

1. You bought a bond five years ago for $935 per bond. The bond is now selling for $980. It also paid $75 in interest per year, which you reinvested in the bond. Calculate the realized rate of return earned on this bond.
2. Refer again to the bond information in Question 1. You expect to hold the bond for three more years, then sell it for $990. If the bond is expected to continue paying $75 per year over the next three years, what is the expected rate of return on the bond during this period?
3. Johnson Motors' bonds have 10 years remaining to maturity. Interest is paid annually, the bonds have a $1,000 par value, and the coupon rate is 8 percent. The bonds have a yield to maturity of 9 percent. What is the current market price of these bonds?
4. **Using a Spreadsheet to Calculate Bond Values.** What is the value of $1,000 bond with a 12-year maturity and an 8 percent coupon rate (paid semiannually) if the required return is 5 percent, 6 percent, 8 percent, and 10 percent?

Face Value	Total Payments	Periodic Coupon Payment	Required Return	=>	The Bond Value Will Be
$1,000	12 × 2 = 24	1,000(.08)/2 = 40	5%		$1,268.27
1,000	24	40	6		1,169.36
1,000	24	40	8		1,000.00
1,000	24	40	10		862.01

5. A 10-year, 12 percent semiannual coupon bond, with a par value of $1,000 sells for $1,100. What is the bond's yield to maturity?
6. **Using a Spreadsheet to Calculate Yield to Maturity.** What is the yield to maturity on the following bonds; all have a maturity of 10 years, a face value of $1,000, and a coupon rate of 9 percent (paid semiannually). The bonds current market values are $945.50, $987.50, $1,090.00, and $1,225.875, respectively.

Market Value	Total Payments	Periodic Coupon Payment	Face Value	=>	The Yield to Maturity Will Be
945.50	10×2 = 20	1,000(.09)/2 = 45	$1,000		9.87%
987.50	20	45	1,000		9.19
1,090.00	20	45	1,000		7.69
1,225.875	20	45	1,000		5.97

7. Galen Corporation has a bond issue outstanding with an annual coupon rate of 7 percent paid quarterly and 4 years remaining until maturity. The par value of the bond is $1,000. Determine the current value of the bond if market conditions justify a 14 percent, compounded quarterly, required rate of return.
8. You have just been offered a bond for $863.73. The coupon rate is 8 percent payable annually, and interest rates on new issues with the same degree of risk are 10 percent. You want to know how many more interest payments you will receive, but the party selling the bond cannot remember. If the par value is $1,000, how many interest payments remain?
9. A bond you are evaluating has a 10 percent coupon rate (compounded semiannually), a $1,000 face value, and is 10 years from maturity.
   a. If the required rate of return on the bond is 6 percent, what is its fair present value?
   b. If the required rate of return on the bond is 8 percent, what is its fair present value?
   c. What do your answers to parts (a) and (b) say about the relation between required rates of return and fair values of bonds?
10. For each of the following situations, identify whether a bond would be considered a premium bond, a discount bond, or a par bond.
    a. A bond's current market price is greater than its face value.
    b. A bond's coupon rate is equal to its yield to maturity.
    c. A bond's coupon rate is less than its required rate of return.
    d. A bond's coupon rate is less than its yield to maturity.
    e. A bond's coupon rate is greater than its yield to maturity.
    f. A bond's fair present value is less than its face value.
11. Calculate the yield to maturity on the following bonds.
    a. A 9 percent coupon (paid semiannually) bond, with a $1,000 face value and 15 years remaining to maturity. The bond is selling at $985.
    b. An 8 percent coupon (paid quarterly) bond, with a $1,000 face value and 10 years remaining to maturity. The bond is selling at $915.
    c. An 11 percent coupon (paid annually) bond, with a $1,000 face value and 6 years remaining to maturity. The bond is selling at $1,065.
12. Calculate the fair present values of the following bonds, all of which pay interest semiannually, have a face value of $1,000, have 12 years remaining to maturity, and have a required rate of return of 10 percent.
    a. The bond has a 6 percent coupon rate.
    b. The bond has an 8 percent coupon rate.

c. The bond has a 10 percent coupon rate.
d. What do your answers to parts (a) through (c) say about the relation between coupon rates and present values?

13. Repeat parts (a) through (c) of Question 12 using a required rate of return on the bond of 8 percent. What do your calculations imply about the relation between the coupon rates and bond price volatility?

14. Calculate the fair present value of the following bonds, all of which have a 10 percent coupon rate (paid semiannually), face value of $1,000, and a required rate of return of 8 percent.
a. The bond has 10 years remaining to maturity.
b. The bond has 15 years remaining to maturity.
c. The bond has 20 years remaining to maturity.
d. What do your answers to parts (a) through (c) say about the relation between time to maturity and present values?

15. Repeat parts (a) through (c) of Question 14 using a required rate of return on the bond of 11 percent. What do your calculations imply about the relation between time to maturity and bond price volatility?

16. STANDARD &POOR'S Go to the S&P Market Insight Web site at **www.mhhe.com/edumarketinsight** and find the long-term debt outstanding for Alcoa Inc. (AA) and Target Corp. (TGT) using the following steps:
Click on "Educational Version of Market Insight"
Enter your Site ID and Click on "Login"
Click on "Company"
Enter "AA" in the "Ticker" box and click on "Go!"
Click on "Excel Analytics"
Click on "FS Ann. Balance Sheet"
This will download the Balance Sheet for Alcoa, which contains the balances for Fixed Income Securities (or long-term debt). Repeat the process by entering "TGT" in the "Ticker" box to get information on Target. If interest rates increase, what will happen to the market values of this debt?

17. What is the economic meaning of duration?

18. a. What is the duration of a two-year bond that pays an annual coupon of 10 percent and has a current yield to maturity of 12 percent? Use $1,000 as the face value.
b. What is the duration of a two-year zero-coupon bond that is yielding 11.5 percent? Use $1,000 as the face value.
c. Given these answers, how does duration differ from maturity?

19. Consider the following two banks:
Bank 1 has assets composed solely of a 10-year, 12 percent coupon, $1 million loan with a 12 percent yield to maturity. It is financed with a 10-year, 10 percent coupon, $1 million CD with a 10 percent yield to maturity.
Bank 2 has assets composed solely of a 7-year, 12 percent, zero-coupon bond with a current value of $894,006.20 and a maturity value of $1,976,362.88. It is financed by a 10-year, 8.275 percent coupon, $1,000,000 face value CD with a yield to maturity of 10 percent.
All securities except the zero-coupon bond pay interest annually.
a. If interest rates rise by 1 percent (100 basis points), how do the values of the assets and liabilities of each bank change?
b. What accounts for the differences between the two banks' accounts?

20. Consider the following.
a. What is the duration of a five-year Treasury bond with a 10 percent semiannual coupon selling at par?
b. What is the duration of the above bond if the yield to maturity (ytm) increases to 14 percent? What if the ytm increases to 16 percent?
c. What can you conclude about the relationship between duration and yield to maturity?

21. Consider the following.
a. What is the duration of a four-year Treasury bond with a 10 percent semiannual coupon selling at par?
b. What is the duration of a three-year Treasury bond with a 10 percent semiannual coupon selling at par?
c. What is the duration of a two-year Treasury bond with a 10 percent semiannual coupon selling at par?
d. What conclusions can you draw from these results between duration and maturity?

22. What is the duration of a zero coupon bond that has 8 years to maturity? What is the duration if the maturity increases to 10 years? If it increases to 12 years?

23. Suppose that you purchase a bond that matures in five years and pays a 13.76 percent coupon rate. The bond is priced to yield 10 percent.
a. Show that the duration is equal to four years.
b. Show that if interest rates rise to 11 percent next year and your investment horizon is four years from today, you will still earn a 10 percent yield on your investment.

24. An insurance company is analyzing the following three bonds, each with 5 years to maturity, and is using duration as its measure of interest rate risk:
a. $10,000 par value, coupon rate = 8%, ytm = .10
b. $10,000 par value, coupon rate = 10%, ytm = .10
c. $10,000 par value, coupon rate = 12%, ytm = .10
What are the durations of each of the three bonds?

25. How is duration related to the interest elasticity of a fixed-income security? What is the relationship between duration and the price of a fixed-income security?

26. You have discovered that when the required return of a bond you own fell by 0.50 percent from 9.75 percent to 9.25 percent, the price rose from $975 to $995. What is the duration of this bond?

The following questions are related to Appendix 3A material in this chapter, located at the book's Web site (**www.mhhe.com/sc3e**).

27. Calculate the present value on a stock that pays $5 in dividends per year (with no growth) and has a required rate of return of 10 percent.

28. A stock you are evaluating paid a dividend last year of $2.50. Dividends have grown at a constant rate of 1.5 percent over the last 15 years and you expect this to continue.
a. If the required rate of return on the stock is 12 percent, what is its fair present value?

b. If the required rate of return on the stock is 15 percent, what is its expected price four years from today?

29. You are considering the purchase of a stock that is currently selling at $64 per share. You expect the stock to pay $4.50 in dividends next year.

a. If dividends are expected to grow at a constant rate of 3 percent per year, what is your expected rate of return on this stock?

b. If dividends are expected to grow at a constant rate of 5 percent per year, what is your expected rate of return on this stock?

c. What do your answers to parts (a) and (b) say about the impact of dividend growth rates on expected rate of returns on stocks?

30. A stock you are evaluating is expected to experience supernormal growth in dividends of 8 percent over the next six years. Following this period, dividends are expected to grow at a constant rate of 3 percent. The stock paid a dividend of $5.50 last year and the required rate of return on the stock is 10 percent. Calculate the stock's fair present value.

APPENDIX 3A: Equity Valuation

View this appendix at
www.mhhe.com/sc3e

APPENDIX 3B: Duration and Immunization

View this appendix at
www.mhhe.com/sc3e

APPENDIX 3C: More on Convexity

View this appendix at
www.mhhe.com/sc3e

Chapter 4

Money Markets

OUTLINE

Chapter NAVIGATOR

1. What are money markets?
2. What are the major types of money market securities?
3. What is the process used to issue Treasury securities?
4. Who are the main participants in money markets?
5. To what extent do foreign investors participate in U.S. money markets?
6. What are the major developments in Euro money markets?

DEFINITION OF MONEY MARKETS: CHAPTER OVERVIEW

LO 1

Money markets exist to transfer funds from individuals, corporations, and government units with short-term excess funds (suppliers of funds) to economic agents who have short-term needs for funds (users of funds). Specifically, in **money markets,** short-term debt instruments (those with an original maturity of one year or less) are issued by economic units that require short-term funds and are purchased by economic units that have excess short-term funds. Once issued, money market instruments trade in active secondary markets. Capital markets serve a similar function for market participants with excess funds to invest for periods of time longer than one year and/or who wish to borrow for periods longer than one year. Market participants who concentrate their investments in capital market instruments also tend to invest in some money market securities so as to meet their short-term liquidity needs. The secondary markets for money market instruments are extremely important, as they serve to reallocate the (relatively) fixed amounts of liquid funds available in the market at any particular time. At the end of 2004 these markets had over $5,260 billion in financial claims outstanding.

IN THE NEWS

Products "Set to Become Popular" Short-Term Funds

Short-term funds, money market funds that invest in assets of up to a year in order to deliver higher returns, are expected to increase in popularity, Moody's Investors Service, the credit rating agency, said yesterday. . . . These funds invest in medium to top-rated fixed income paper and money market securities with average maturities of up to 365 days.

"The driver has been the low interest rates of recent years," said Douglas Rivkin, senior credit officer at Moody's. "Institutional investors have been seeking better returns for their balances. They can do five to 30 basis points in yield better than money market funds." Short-term funds have attracted more than $500 billion in assets this year in the U.S. market, according to estimates from iMoneyNet quoted by Moody's.

"The money invested in short-term funds does not yet compare with the some $2,000 billion invested in money market mutual funds (but) we expect to see additional growth in this cash management asset class."

Source: *Financial Times*, October 8, 2004, p. 45, by Charles Batchelor. **www.ftbusiness.com**

DO YOU UNDERSTAND?

In this chapter, we present an overview of money markets. We define and review the various money market instruments that exist, the new issue and secondary market trading process for each, and the market participants trading these securities. We also look at international money markets and instruments, taking a particularly close look at the Euro markets.

MONEY MARKETS

money markets
Markets that trade debt securities or instruments with maturities of less than one year.

opportunity cost
The forgone interest cost from the holding of cash balances when they are received.

The need for money markets arises because the immediate cash needs of individuals, corporations, and governments do not necessarily coincide with their receipts of cash. For example, the federal government collects taxes quarterly; however, its operating and other expenses occur daily. Similarly, corporations' daily patterns of receipts from sales do not necessarily occur with the same pattern as their daily expenses (e.g., wages and other disbursements). Because excessive holdings of cash balances involve a cost in the form of forgone interest, called **opportunity cost,** those economic units with excess cash usually keep such balances to the minimum needed to meet their day-to-day transaction requirements. Consequently, holders of cash invest "excess" cash funds in financial securities that can be quickly and relatively costlessly converted back to cash when needed with little risk of loss of value over the short investment horizon. Money markets are efficient in performing this service in that they enable large amounts of money to be transferred from suppliers of funds to users of funds for short periods of time both quickly and at low cost to the transacting parties. In general, a money market instrument provides an investment opportunity that generates a higher rate of interest (return) than holding cash, but it is also very liquid and (because of its short maturity) has relatively low default risk.

Notice, from the description above, that money markets and money market securities or instruments have three basic characteristics. First, money market instruments are generally sold in large denominations (often in units of $1 million to $10 million). Most money market participants want or need to borrow large amounts of cash, so that transactions costs are low relative to the interest paid. The size of these initial transactions prohibits most individual investors from investing directly in money market securities. Rather, individuals generally invest in money market securities indirectly, with the help of financial institutions such as money market mutual funds or short-term funds (see the In the News box).

default risk
The risk of late or nonpayment of principal or interest.

Second, money market instruments have low **default risk;** the risk of late or nonpayment of principal and/or interest is generally small. Since cash lent in the money markets

DO YOU UNDERSTAND?

must be available for a quick return to the lender, money market instruments can generally be issued only by high-quality borrowers with little risk of default.

Finally, money market securities must have an original maturity of one year or less. Recall from Chapter 3 that the longer the maturity of a debt security, the greater is its interest rate risk and the higher is its required rate of return. Given that adverse price movements resulting from interest rate changes are smaller for short-term securities, the short-term maturity of money market instruments helps lower the risk that interest rate changes will significantly affect the security's market value and price.

YIELDS ON MONEY MARKET SECURITIES

For many of the money market securities discussed below, returns are measured and quoted in a manner that does not allow them to be evaluated using the time value of money equations. For example, some securities' interest rates or returns are based on a 360-day year, while others are based on a 365-day year. It is therefore inappropriate to compare annual interest rates on the various money market securities as well as on short-term and long-term securities without adjusting their interest rates for differences in the securities' characteristics.

Effective Annual Return

The quoted annual nominal interest rate (i) on money market securities with a maturity of less than one year can be converted to an effective annual interest return (EAR) using the following equation:[1]

$$EAR = \left(\frac{1 + i}{365/h}\right)^{365/h} - 1$$

where h = number of days to maturity.

EXAMPLE 5-1 Calculation of EAR on a Money Market Security

Suppose you can invest in a money market security that matures in 75 days and offers a 7 percent annual interest rate. The effective annual interest return on this security is:

$$EAR = \left(\frac{1 + .07}{365/75}\right)^{365/75} - 1 = 7.20\%$$

Discount Yields

Some money market instruments (e.g., Treasury bills and commercial paper) are bought and sold on a discount basis. That is, instead of directly received interest payments over the investment horizon, the return on these securities results from the purchase of the security at a discount from its face value (P_0) and the receipt of face value (P_f) at maturity, as we show in the following time line.

P_0 ——————— P_f
0 Maturity (days)

Further, yields on these securities normally use a 360-day year rather than a 365-day year to calculate interest return. Interest rates on discount securities, or discount yields (i_{dy}), are quoted on a discount basis using the following equation:

$$i_{dy} = [(P_f - P_0)/P_f](360/h)$$

1. This equation assumes that as these short-term securities mature they can be reinvested for the remainder of the year at the same interest rate.

where

P_f = Face value
P_0 = Discount price of the security
h = Number of days until maturity

There are several features of a discount yield that make it difficult to compare with yields on other (nondiscount) securities—for example, U.S. Treasury bonds—that pay a (coupon) interest payment semiannually. The annual interest rate on nondiscount securities (such as U.S. Treasury bonds) is often referred to as the nominal or bond equivalent yield (i_{bey}).[2] The bond equivalent yield used for comparison with a discount money market instrument of short (less than one year) maturity can be calculated as follows:

$$i_{bey} = [(P_f - P_0)/P_0](365/h)$$

Notice the discount yield uses the terminal price, or the security's face value (P_f), as the base price in calculating an annualized interest rate. By contrast, bond equivalent yields are based on the purchase price (P_0) of a security. Further, and as already mentioned, discount yields often use a 360-day rather than a 365-day year to compute interest returns. An appropriate comparison of interest rates on discount securities versus nondiscount securities, adjusting for both the base price and days in the year differences, requires converting a discount yield into a bond equivalent yield in the following manner:

$$i_{bey} = i_{dy}(P_f/P_0)\ (365/360)$$

Finally, neither of these interest rates considers the effects of compounding of interest during the less than one year investment horizon. The *EAR* on a discount security would be calculated by applying the calculated bond equivalent yield (i_{bey}) for the discount security to the *EAR* equation, as illustrated in Example 5–1 (i.e., setting i equal to i_{bey} in Example 5–1).

EXAMPLE 5–2 Comparison of Discount Yield, Bond Equivalent Yield, and EAR

Suppose you can purchase a $1 million Treasury bill that is currently selling on a discount basis (i.e., with no explicit interest payments) at 97½ percent of its face value. The T-bill is 140 days from maturity (when the $1 million will be paid). Depending on the setting in which you are interested, any one of the following three yields or interest rates could be appropriate:

Discount yield: $i_{dy} = [(\$1\text{m.} - \$975{,}000)/\$1\text{m.}](360/140) = 6.43\%$
Bond equivalent yield: $i_{bey} = [(\$1\text{m.} - \$975{,}000)/\$975{,}000](365/140) = 6.68\%$
EAR: $EAR = [1 + .0668/(365/140)]^{365/140} - 1 = 6.82\%$

Single-Payment Yields

Some money market securities (e.g., jumbo CD, fed funds) pay interest only once during their lives: at maturity. Thus, the single-payment security holder receives a terminal payment consisting of interest plus the face value of the security, as we show in the following time line. Such securities are special cases of the pure discount securities that only pay the face value on maturity.

Further, quoted nominal interest rates on single-payment securities (or single-payment yield, i_{spy}) normally assume a 360-day year. In order to compare interest rates on these securities with others, such as U.S. Treasury bonds, that pay interest based on a 365-day year, the nominal interest rate must be converted to a bond equivalent yield in the following manner:

$$i_{bey} = i_{spy}(365/360)$$

2. We describe nominal yields and bond valuation in detail in Chapter 3.

Further, allowing for interest rate compounding, the EAR for single-payment securities must utilize the bond equivalent yield as follows:

$$EAR = \left[1 + i_{spy}\frac{365/360}{365/h}\right]^{365/h} - 1$$

$$EAR = [1 + i_{bey}/(365/h)]^{365/h} - 1$$

EXAMPLE 5-3 Comparison of Single-Payment Yield, Bond Equivalent Yield, and EAR

Suppose you can purchase a $1 million jumbo CD that is currently 105 days from maturity. The CD has a quoted annual interest rate of 5.16 percent for a 360-day year. The bond equivalent yield is calculated as:

$$i_{bey} = 5.16\%(365/360) = 5.232\%$$

The EAR on the CD is calculated as:

$$EAR = [1 + (.05232)/(365/105)]^{365/105} - 1 = 5.33\%$$

DO YOU UNDERSTAND?

Table 5–1 lists various money market instruments and their quoted interest rates, as reported in *The Wall Street Journal* for November 9, 2004. As we proceed with the discussion of the various money market instruments, pay particular attention to the convention used to state returns in the various money markets. For example, Treasury bill rates are stated as discount yields and use a 360-day year. Federal funds and repurchase agreements are stated on a bond equivalent yield basis but use a 360-day year. Commercial paper, negotiable certificates of deposit, and bankers acceptance yields are quoted as discount yields. Differences in the convention used to calculate yields must be considered particularly when comparing returns across various securities.

MONEY MARKET SECURITIES

A variety of money market securities are issued by corporations and government units to obtain short-term funds. These securities include Treasury bills, federal funds, repurchase agreements, commercial paper, negotiable certificates of deposit, and banker's acceptances. In this section, we look at the characteristics of each of these. Table 5–2 defines each of the money market securities and Table 5–3 lists the amounts of each outstanding and the interest rate on each of these instruments in 1990 and 2004.

Treasury Bills

Treasury bills

Short-term obligations of the U.S. government issued to cover government budget deficits and to refinance maturing government debt.

www.federalreserve.gov

Treasury bills (T-bills) are short-term obligations of the U.S. government issued to cover current government budget shortfalls (deficits)[3] and to refinance maturing government debt. In 2004 there were $981.9 billion of Treasury bills outstanding. As discussed in Chapter 4, T-bills (and other Treasury securities) are also used by the Federal Reserve as a tool in conducting monetary policy through open market operations. T-bills are sold through an auction process (described below). Original maturities are 13 weeks or 26 weeks, and they are issued in denominations of multiples of $1,000. The minimum allowable denomination for a T-bill bid is $1,000. A typical purchase in the newly issued T-bill market is a round lot of $5 million. However, existing T-bills can be bought and sold

3. The excess of U.S. government expenditures minus revenues.

TABLE 5–1 Various U.S. Money Market Security Rates

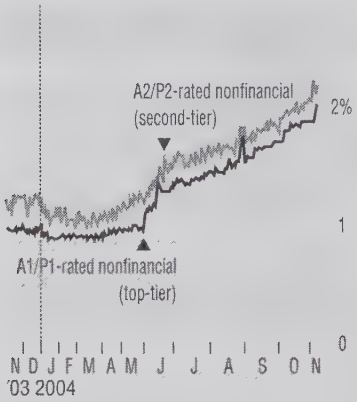
Money Rates

Tuesday, November 9, 2004

The key U. S. and foreign annual interest rates below are a guide to general levels but don't always represent actual transactions.

Commercial Paper

Yields paid by corporations for short-term financing, typically for daily operation



Source: Federal Reserve

Prime Rate: 4.75% (effective 09/22/04). The base rate on corporate loans posted by at least 75% of the nation's 30 largest banks.
Discount Rate (Primary): 2.75% (effective 09/21/04).
Federal Funds: 1.875% high, 1.640% low, 1.750% near closing bid, 1.875% offered. Effective rate: 1.79%. Source: Prebon Yamane (USA) Inc. Federal-funds target rate: 1.750% (effective 09/21/04).
Call Money: 3.50% (effective 09/22/04).
Commercial Paper: Placed directly by General Electric Capital Corp.: 2.02% 30 to 44 days; 2.04% 45 to 59 days; 2.14% 60 to 89 days; 2.20% 90 to 119 days; 2.25% 120 to 149 days; 2.30% 150 to 179 days; 2.37% 180 to 209 days; 2.42% 210 to 239 days; 2.46% 240 to 270 days.
Euro Commercial Paper: Placed directly by General Electric Capital Corp.: 2.05% 30 days; 2.11% two months; 2.12% three months; 2.13% four months; 2.16% five months; 2.18% six months.
Dealer Commercial Paper: High-grade unsecured notes sold through dealers by major corporations: 2.04% 30 days; 2.13% 60 days; 2.21% 90 days.
Certificates of Deposit: 2.05% one month; 2.22% three months; 2.40% six months.
Bankers Acceptances: 2.04% 30 days; 2.16% 60 days; 2.22% 90 days; 2.28% 120 days; 2.36% 150 days; 2.42% 180 days. Source: Prebon Yamane (USA) Inc.
Eurodollars: 2.07% - 2.04% one month; 2.19% - 2.15% two months; 2.25% - 2.21% three months; 2.31% - 2.27% four months; 2.35% - 2.34% five months; 2.44% - 2.40% six months. Source: Prebon Yamane (USA) Inc.
London Interbank Offered Rates (Libor): 2.09125% one month; 2.27375% three months; 2.46375% six months; 2.76625% one year. Effective rate for contracts entered into two days from date appearing at top of this column.
Euro Libor: 2.10013% one month; 2.17000% three months; 2.23738% six months; 2.37750% one year. Effective rate for contracts entered into two days from date appearing at top of this column.
Euro Interbank Offered Rates (Euribor): 2.101% one month; 2.170% three months; 2.239% six months; 2.380% one year. Source: Reuters.
Foreign Prime Rates: Canada 4.25%; European Central Bank 2.00%; Japan 1.375%; Switzerland 2.60%; Britain 4.75%.
Treasury Bills: Results of the Monday, November 8, 2004, auction of short-term U.S. government bills, sold at a discount from face value in units of $1,000 to $1 million: 2.045% 13 weeks; 2.260% 26 weeks. Tuesday, November 9, 2004 auction: 1.900% 4 weeks.
Overnight Repurchase Rate: 1.75%. Source: Garban Intercapital.
Freddie Mac: Posted yields on 30-year mortgage commitments. Delivery within 30 days 5.47%, 60 days 5.52%, standard conventional fixed-rate mortgages: 2.875%, 2% rate capped one-year adjustable rate mortgages.
Fannie Mae: Posted yields on 30 year mortgage commitments (priced at par) for delivery within 30 days 5.52%, 60 days 5.57%, standard conventional fixed-rate mortgages; 3.35%, 6/2 rate capped one-year adjustable rate mortgages. Constant Maturity Debt Index: 2.221% three months; 2.428% six months; 2.672% one year.
Merrill Lynch Ready Assets Trust: 1.20%.
Consumer Price Index: September, 189.9, up 2.5% from a year ago. Bureau of Labor Statistics.

Source: *The Wall Street Journal*, November 10, 2004, p. C12. Reprinted by permission of *The Wall Street Journal*. © 2004 Dow Jones & Company, Inc. All Rights Reserved Worldwide. **www.wsj.com**

TABLE 5–2 Money Market Instruments

Treasury Bills—short-term obligations issued by the U.S. government.
Federal Funds—short-term funds transferred between financial institutions usually for no more than one day.
Repurchase Agreements—agreements involving the sale of securities by one party to another with a promise to repurchase the securities at a specified date and price.
Commercial Paper—short-term unsecured promissory notes issued by a company to raise short-term cash.
Negotiable Certificates of Deposit—bank-issued time deposit that specifies an interest rate and maturity date and is negotiable (saleable on a secondary market).
Banker Acceptances—time drafts payable to a seller of goods, with payment guaranteed by a bank.

TABLE 5–3 Money Market Instruments Outstanding, December 1990 and 2004
(in billions of dollars)

	Amount Outstanding		Rate of Return	
	1990	2004	1990	2004
Treasury bills	$527.0	$981.9	6.68%	2.15%
Federal funds and repurchase agreements	372.3	1,585.1	7.31	1.83
Commercial paper	537.8	1,309.7	8.14	1.89
Negotiable certificates of deposit	546.9	1,379.4	8.13	2.28
Banker's acceptance	52.1	4.4	7.95	2.04

Source: Federal Reserve Board Web site, May 1991 and November 2004, various tables. **www.federalreserve.gov**

in an active secondary market through government securities dealers who purchase Treasury bills from the U.S. government and resell them to investors. Thus, investors wanting to purchase smaller amounts of T-bills can do so through a dealer for a fee.

Because they are backed by the U.S. government, T-bills are virtually default risk free. In fact, T-bills are often referred to as *the* risk-free asset in the United States. Further, because of their short-term nature and active secondary market, T-bills have little liquidity risk.

3

The New Issue and Secondary Market Trading Process for Treasury Bills. The U.S. Treasury has a formal process by which it sells new issues of Treasury bills through its regular **Treasury bill auctions.** Every week (usually on a Thursday), the amount of new 13-week and 26-week T-bills the Treasury will offer for sale is announced. Bids may be submitted by government securities dealers, financial and nonfinancial corporations, and individuals and must be received by a Federal Reserve Bank (over the Internet (through Treasury Direct), by phone, or by paper form) by the deadline of 1 P.M. on the Monday following the auction announcement. Allocations and prices are announced the following morning (Tuesday) and the T-bills are delivered on the Thursday following the auction.

Treasury bill auctions
The formal process by which the U.S. Treasury sells new issues of Treasury bills.
www.ustreas.gov

Submitted bids can be either competitive bids or noncompetitive bids. As of 1998, all successful bidders (both competitive and noncompetitive) are awarded securities at the same price, which is the price equal to the lowest price of the competitive bids accepted (as will be explained below). Prior to this, Treasury security auctions were discriminatory auctions in that different successful bidders paid different prices (their bid prices). Appendix A to this chapter, located at the book's Web site (**www.mhhe.com/sc3e**), discusses the reasons behind the change and the benefits to the U.S. Treasury from a single price auction.

Competitive bids specify the desired quantity of T-bills and the bid price. The highest bidder receives the first allocation (allotment) of T-bills, and subsequent bids are filled in decreasing order of the bid until all T-bills auctioned that week are distributed. The price paid by all bidders is, then, the lowest price of the accepted competitive bidders. Any competitive bidder can submit more than one bid. However, no bidder can legally receive more than 35 percent of the T-bills involved in any auction. This rule limits the ability of one bidder to "squeeze" the market. Competitive bids are generally used by large investors and government securities dealers, and make up the majority of the auction market. Table 5–4 shows the results of the Treasury auction on November 8, 2004. At this auction, 50.73 and 53.27 percent of the submitted bids were accepted for the 13- and 26-week T-bills, respectively.

Figure 5–1 illustrates the T-bill auction for the 13-week T-bills. The highest accepted bid on the 13-week T-bills was 99.4975 percent of the face value of the T-bills. Bids were filled at prices below the high. The lowest accepted bid price was 99.48875 percent. The median accepted bid price was 99.4925 percent. All bidders who submitted prices *above* 99.48875 percent (categories 1 through 5 in Figure 5–1) were awarded in full (winning bids) at a price of 99.48875 percent. Thus, those who submitted a bid at a price greater than

TABLE 5–4 Treasury Auction Results, November 8, 2004

	13-Week Treasury Bill Auction	26-Week Treasury Bill Auction
Bids tendered (in millions)	$37,959.1	$33,988.5
Bids accepted (in millions)	$19,254.8	$18,104.7
Noncompetitive bids (in millions)	$1,745.3	$895.5
Price	99.48875%	98.86372%
High Price	99.49750%	98.87881%
Low price	99.48875%	98.86372%
Median price	99.49250%	98.86875%

Source: Department of Treasury Web site, Bureau of Public Debt, November 8, 2004. **www.ustreas.gov**

99.48875 percent paid less than their bid price yet received their full allocation of T-bills requested. Bidders who submitted a price below 99.48875 percent (categories 7 and beyond in Figure 5–1) received no allocation of the auctioned T-bills. A portion, but not all, of the bids submitted at 99.48875 were filled (category 6 in Figure 5–1). Bids submitted at 99.48875 were filled on a pro rata (proportional) basis until the supply available was exhausted.

With noncompetitive bids, the bidder indicates the quantity of T-bills he or she wants to buy and agrees to pay the lowest price of the winning competitive bids. Noncompetitive bidders get a preferential allocation—that is, all these bids are met before the remaining T-bills are allocated to the competitive bidders. Notice, from Table 5–4, that 10.06 percent ($1,745.3m./$19,254.8m.) and 4.95 percent ($895.5m./$18,104.7m.), respectively, of the accepted bids at the November 8, 2004, Treasury auction were noncompetitive for 13- and 26-week T-bills. This resulted in a supply of T-bills available to competitive bidders (S_C) that is lower than the total supply (S_T), because of the preferential bidding status of noncompetitive bidders (i.e., noncompetitive bidders always receive a 100 percent allocation of their bids). Noncompetitive bids are limited to $1 million or less and allow small investors to participate in the T-bill auction market without incurring large risks. Small investors who are unfamiliar with money market interest rate movements can use a noncompetitive bid to avoid bidding a price too low to receive any of the T-bills.

The secondary market for T-bills is the largest of any U.S. money market security. At the heart of this market are those securities dealers designated as primary government securities dealers by the Federal Reserve Bank of New York (consisting of 22 financial institutions) who purchase the majority of the T-bills sold competitively at auction and who

www.newyorkfed.org

FIGURE 5–1 Treasury Auction Results

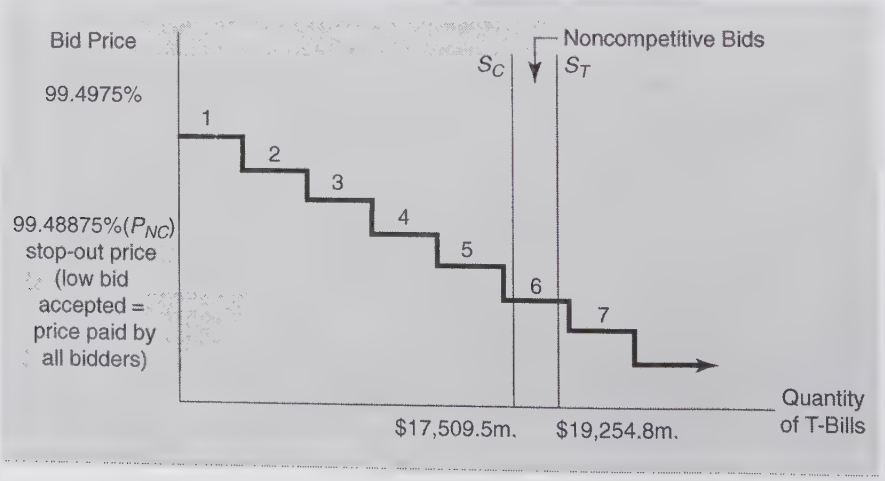
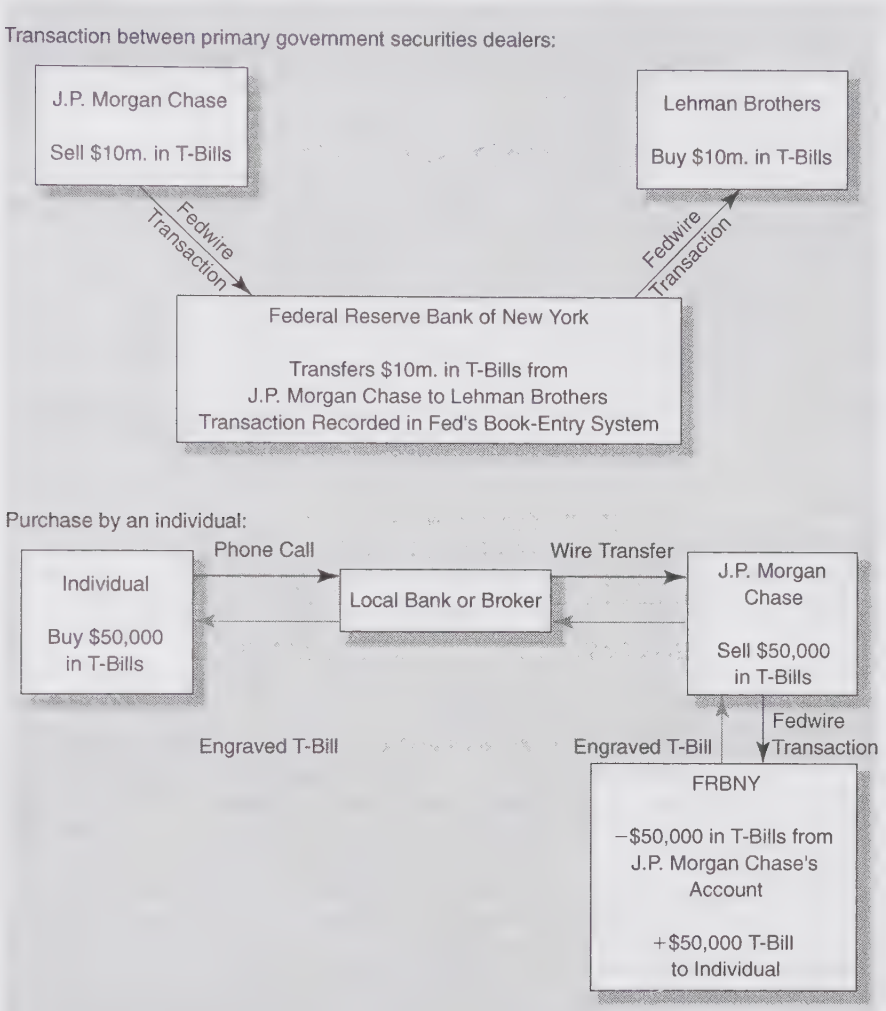


FIGURE 5–2 Secondary Market Treasury Bill Transaction



create an active secondary market. In addition, there are many (approximately 500) smaller dealers who directly trade in the secondary market. Primary dealers make a market for T-bills by buying and selling securities for their own account and by trading for their customers, including depository institutions, insurance companies, pension funds, and so on. T-bill transactions by primary dealers averaged $545 billion per day in November 2004.

The T-bill market is decentralized, with most trading transacted over the telephone. Brokers keep track of the market via closed circuit television screens located in trading rooms of the primary dealers that display bid and asked prices available at any point in time. Treasury markets are generally open from 9:00 A.M. to 3:30 P.M. EST.

Secondary market T-bill transactions between primary government securities dealers are conducted over the Federal Reserve's wire transfer service—Fedwire (see Chapter 4)—and are recorded via the Federal Reserve's book-entry system.[4] We illustrate a transaction in Figure 5–2.

4. With a book-entry system, no physical documentation of ownership exists. Rather, ownership of Treasury securities is accounted for electronically by computer records.

SEARCH THE SITE

Go to the Bureau of Public Debt Web site at **www.publicdept.treas.gov** and find the latest information on 13-week and 26-week Treasury bill auctions.

Under "Bills, Notes, Bonds–Tips," click on "Auction Info"

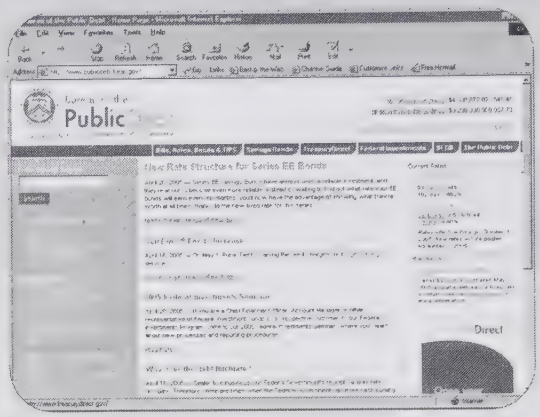
Click on "200X" (most current year)

Click on "Auction Results Press Releases"

Click on "13-week Bill" and then "26-week Bill"

Under the most recent date, click on "*Results*"

This will bring up the relevant tables.



Questions

1. What are the high, low, and median prices on the most recent issues?
2. What is the dollar value of tendered and accepted bids for the most recent issues?
3. What is the dollar value of noncompetitive bids on the most recent issues?

www.newyorkfed.org

For example, if J.P. Morgan Chase wants to sell $10 million of T-bills to Lehman Brothers, J.P. Morgan Chase would instruct its district Federal Reserve Bank—the Federal Reserve Bank of New York (FRBNY)—to electronically transfer the (book-entry) T-bills, via the Fedwire, from its account to Lehman Brothers (also in the district of the FRBNY). The transaction would be recorded in the Fed's book-entry system with no physical transfer of paper necessary. An individual wanting to purchase $50,000 of T-bills in the secondary market must contact his or her bank or broker. A bank or broker that is not a primary government securities dealer or a secondary market dealer must contact (via phone, fax, or wire) one of these dealers (e.g., J.P. Morgan Chase) to complete the transaction. The T-bill dealer will instruct its local Federal Reserve Bank to increase (credit) its T-bill account at the Fed. In exchange for the investor's $50,000, these securities are subsequently recorded in the dealer's book-entry system as an issue held for the investor. T-bill dealers maintain records identifying owners of all Treasury securities held in its account in the book-entry system.

Treasury Bill Yields. As we discussed above, Treasury bills are sold on a discount basis. Rather than directly paying interest on T-bills (the coupon rate is zero), the government issues T-bills at a discount from their par (or face) value. The return comes from the difference between the purchase price paid for the T-bill and the face value received at maturity. Table 5–5 lists T-bill rates as quoted in *The Wall Street Journal* for trading on November 10, 2004. Column 1 in the quote lists the maturity date of the T-bill (note the maximum maturity is less than one year). Column 2 specifies the remaining number of days until each T-bill matures. For example, at the close of trading on November 10, 2004, the T-bill maturing on November 26, 2004, would trade for an additional 16 days. Column 3, labeled BID, is the discount yield (defined below) on the T-bill given the current selling price available to T-bill holders (i.e., the price dealers are willing to pay T-bill holders to purchase their T-bills for them). Column 4, labeled ASKED, is the discount yield based on the current purchase price set by dealers that is available to investors (i.e., potential T-bill buyers). The percentage difference in the ask

TABLE 5–5 Treasury Bill Rates

(1)	(2)	(3)	(4)	(5)	(6)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nov 12 04	2	1.63	1.62	0.04	1.64
Nov 18 04	8	1.82	1.81	0.03	1.84
Nov 26 04	**16**	**1.86**	**1.85**	**0.01**	**1.85**
Dec 02 04	22	1.84	1.83	–	1.86
Dec 09 04	29	1.88	1.87	–	1.90
Dec 16 04	36	1.84	1.83	–	1.86
Dec 23 04	43	1.91	1.90	0.03	1.93
Dec 30 04	50	1.92	1.91	–	1.94
Jan 06 05	57	1.92	1.91	0.02	1.94
Jan 13 05	64	1.94	1.93	–	1.96
Jan 20 05	**71**	**1.94**	**1.93**	**−0.01**	**1.96**
Jan 27 05	78	1.95	1.94	–	1.98
Feb 03 05	85	2.01	2.00	–	2.04
Feb 10 05	92	2.04	2.03	–	2.07
Feb 17 05	99	2.05	2.04	–	2.08
Feb 24 05	106	2.05	2.04	–	2.03
Mar 03 05	113	2.10	2.09	–	2.13
Mar 30 05	120	2.12	2.11	–	2.15
Mar 17 05	127	2.12	2.11	–	2.16
Mar 24 05	134	2.14	2.13	–	2.18
Mar 31 05	141	2.14	2.13	–	2.18
Apr 07 05	148	2.18	2.17	–	2.22
Apr 14 05	**155**	**2.20**	**2.19**	**0.01**	**2.24**
Apr 21 05	162	2.21	2.20	–	2.25
Apr 28 05	169	2.23	2.22	–	2.27
May 05 05	176	2.23	2.22	–	2.28
May 12 05	183	2.25	2.24	−0.01	2.30

Source: *The Wall Street Journal*, November 11, 2004, p. C15. Reprinted by permission of *The Wall Street Journal*. © 2004 Dow Jones & Company, Inc. All Rights Reserved Worldwide. **www.wsj.com**

and bid yields is known as the spread. The spread is essentially the profit the dealers make in return for conducting the trade for investors. It is part of the transaction cost incurred by investors for the trade. Column 5, labeled CHG, is the change in the Asked (discount) yield from the previous day's closing yield. Finally, the last column (column 6), labeled ASK YLD, is the Asked discount yield converted to a bond equivalent yield. As discussed above, the discount yield (dy) on a T-bill is calculated as follows:

$$i_{\text{T-bill}}(dy) = \frac{P_f - P_0}{P_f} \times \frac{360}{h}$$

EXAMPLE 5–4 Calculating a Treasury Bill Asked Discount Yield

Suppose that you purchase the 155-day T-bill maturing on April 14, 2005, for $9,905.71. The T-bill has a face value of $10,000. The T-bill's Asked discount yield is reported as:

$$i_{\text{T-bill}}(dy) = \frac{\$10{,}000 - 9{,}905.71}{\$10{,}000} \times \frac{360}{155} = 2.19\%$$

Thus, 2.19 percent is the asked discount yield on this T-bill reported in Table 5–5.

As described above, the discount yield differs from a true rate of return (or bond equivalent yield) for two reasons: (1) the base price used is the face value of the T-bill and not the purchase price of the T-bill, and (2) a 360-day year rather than a 365-day year is used. The bond equivalent yield uses a 365-day year and the purchase price, rather than the face value of the T-bill, as the base price. Thus, the formula for a bond equivalent yield on a T-bill, $i_{\text{T-bill}}$ (*bey*), is:

$$i_{\text{T-bill}}(bey) = \frac{P_f - P_0}{P_0} \times \frac{360}{h}$$

For example, the bond equivalent yield (or ASK YLD reported in Table 5–5) in Example 5–4 is calculated as:[5]

$$i_{\text{T-bill}} = \frac{\$10{,}000 - \$9{,}905.71}{\$9{,}905.71} \times \frac{360}{155} = 2.24\%$$

A Treasury bill's price (such as that used in the examples above) can be calculated from the quote reported in the financial press (e.g., *The Wall Street Journal*) by rearranging the yield equations listed above. Specifically, for the asked discount yield, the required market ask price would be:

$$P_0 = P_f - \left[i_{\text{T-bill}}(dy) \times \frac{h}{360} \times P_f \right]$$

and for the bond equivalent yield:

$$P_0 = P_f / \left[1 = \left(i_{\text{T-bill}}(bey) \times \frac{h}{365} \right) \right]$$

EXAMPLE 5–5 Calculation of Treasury Bill Price from a *Wall Street Journal* Quote

From Table 5–5, the asked (or discount) yield on the T-bill maturing on January 20, 2005, (or 71 days from November 10, 2004), is 1.93 percent. The T-bill price for these T-bills is calculated as:

$$P_0 = \$10{,}000 - \left[.0193 \times \frac{71}{360} \times \$10{,}000 \right] = \$9{,}961.94$$

or using the ASK YLD (or the bond equivalent yield) on the T-bill, 1.96 percent:

$$P_0 = \$10{,}000 / \left[1 + \left(.0196 \times \frac{71}{365} \right) \right] = \$9{,}962.02$$

Federal Funds

federal funds

Short-term funds transferred between financial institutions, usually for a period of one day.

Federal funds (fed funds) are short-term funds transferred between financial institutions, usually for a period of one day. For example, commercial banks trade fed funds in the form of excess reserves held at their local Federal Reserve Bank. That is, one commercial bank may be short of reserves, requiring it to borrow excess reserves from another bank that has a surplus. The institution that borrows fed funds incurs a liability on its balance sheet, "federal funds purchased," while the institution that lends the fed funds records an asset, "federal

5. Remember, from above, that the effective annual return (over a 12-month investment period) on this T-bill is:

$$(1 + .0224/(365/155))^{365/155} - 1 = 2.25\%$$

federal funds rate
The interest rate for borrowing fed funds.

funds sold." The overnight (or one day) interest rate for borrowing fed funds is the **federal funds rate.** The fed funds rate is a function of the supply and demand for federal funds among financial institutions and the effects of the Federal Reserve's trading through the FOMC (as discussed in Chapter 4).

Federal Funds Yields. Federal funds (fed funds) are single-payment loans—they pay interest only once, at maturity. Further, fed funds transactions take the form of short-term (mostly overnight) *unsecured* loans. Quoted interest rates on fed funds, i_{ff}, assume a 360-day year. Therefore, to compare interest rates on fed funds with other securities such as Treasury bills, the quoted fed funds interest rate must be converted into a bond equivalent rate or yield, i_{bey}.

EXAMPLE 5–6 Conversion of Federal Funds Rate of Interest to a Bond Equivalent Rate

From Table 5–1, the overnight fed funds rate on November 9, 2004, was 1.875 percent. The conversion of the fed funds rate to a bond equivalent rate is calculated as follows:

$$i_{bey} = i_{ff}(365/360)$$
$$= 1.875\%\ (365/360) = 1.901\%$$

In addition to being the cost of unsecured, overnight, interbank borrowing, the federal funds rate is of particular importance because, as was discussed in Chapter 4, it is a focus or target rate in the conduct of monetary policy.

Trading in the Federal Funds Market. The fed funds market is a highly liquid and flexible source of funding for commercial banks and savings banks. Commercial banks, especially the largest commercial banks, conduct the vast majority of transactions in the fed funds market. Fed funds transactions are created by banks borrowing and lending excess reserves held at their Federal Reserve Bank (see Chapter 4), using Fedwire, the Federal Reserve's wire transfer network, to complete the transaction. Banks with excess reserves lend fed funds, while banks with deficient reserves borrow fed funds.

Federal funds transactions can be initiated by either the lending or the borrowing bank, with negotiations between any pair of commercial banks taking place directly over the telephone. Alternatively, trades can be arranged through fed funds brokers (such as Garban Ltd. and RMJ Securities Corp), who charge a small fee for bringing the two parties to the fed funds transaction together.[6]

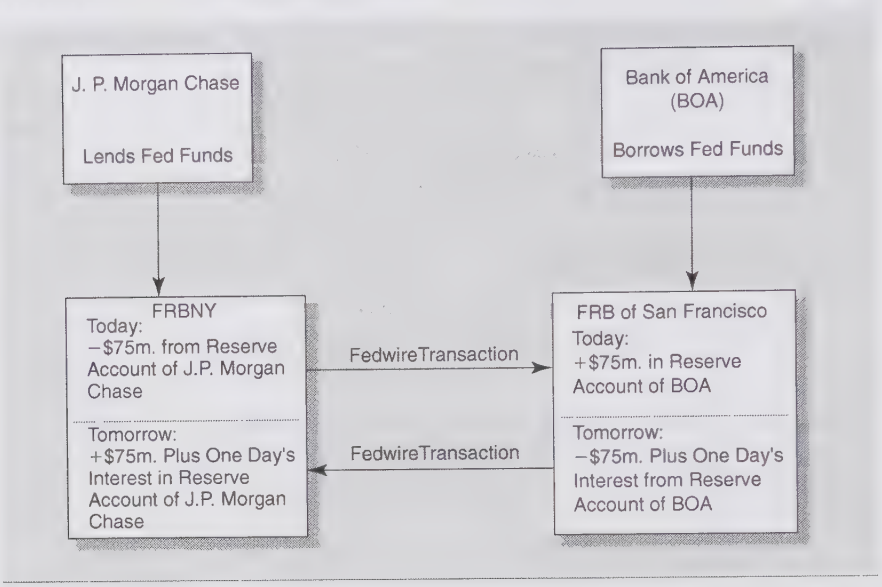
correspondent banks
Banks with reciprocal accounts and agreements.

Figure 5–3 illustrates a fed funds transaction. For example, a bank that finds itself with $75 million in excess reserves (e.g., J.P. Morgan Chase) can call its **correspondent banks** (banks with which it has reciprocal accounts and agreements)[7] to see if they need overnight reserves. The bank will then sell its excess reserves to those correspondent banks that offer the highest rates for these fed funds (e.g., Bank of America). When a transaction is agreed upon, the lending bank (J.P. Morgan Chase) instructs its district Federal Reserve Bank (e.g., the FRBNY) to transfer the $75 million in excess reserves to the borrowing bank's (Bank of America) reserve account at its Federal Reserve Bank (e.g., the Federal Reserve Bank of San Francisco). The Federal Reserve System's wire transfer network, Fedwire, is used to complete the transfer of funds. The next day, the funds are transferred back, via Fedwire, from the borrowing bank to the lending bank's

6. Brokerage fees are often as low as 50 cents per $1 million transacted.

7. Correspondent bank relations are discussed in more detail in Chapter 12.

FIGURE 5–3 Federal Funds Transaction



reserve account at the Federal Reserve Bank plus one day's interest.[8] Overnight fed funds loans will likely be based on an oral agreement between the two parties and are generally unsecured loans.

Repurchase Agreements

repurchase agreement
An agreement involving the sale of securities by one party to another with a promise to repurchase the securities at a specified price and on a specified date.

A **repurchase agreement** (repo or RP) is an agreement involving the sale of securities by one party to another with a promise to repurchase the securities at a specified price and on a specified date in the future. Thus, a repurchase agreement is essentially a collateralized fed funds loan, with the collateral backing taking the form of securities. The securities used most often in repos are U.S. Treasury securities (e.g., T-bills) and government agency securities (e.g., Fannie Mae). A **reverse repurchase agreement** (reverse repo) is an agreement involving the purchase (buying) of securities by one party from another with the promise to sell them back at a given date in the future.

reverse repurchase agreement
An agreement involving the purchase of securities by one party from another with the promise to sell them back.

Because the parties in every repurchase agreement transaction have opposite perspectives, the titles repo and reverse repo can be applied to the same transaction. That is, a given transaction is a repo from the point of view of the securities' seller and a reverse repo from the point of view of the securities' buyer. Whether a transaction is termed a *repo* or a *reverse repo* generally depends on which party initiated the transaction. Most repos have very short terms to maturity (generally from 1 to 14 days), but there is a growing market for longer-term 1- to 3-month repos. Repos with a maturity of less than one week generally involve denominations of $25 million or more. Longer-term repos are more often in denominations of $10 million.

Many commercial firms, with idle funds in their deposit accounts at banks, use repos as a way to earn a small return until these funds are needed. In this case the firm uses its

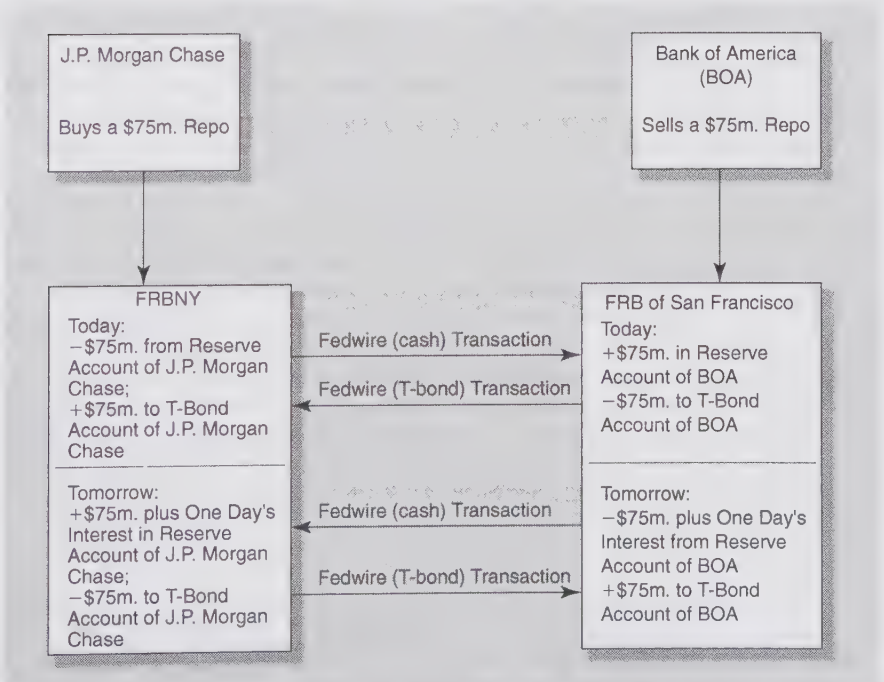
8. Increasingly, participants in the fed funds markets do not hold balances at the Federal Reserve (e.g., commercial banks that do not belong to the Federal Reserve System). In this case, the fed funds transaction is settled in immediately available funds—fed funds on deposit at the lending bank that may be transferred or withdrawn with no delay. A federal funds broker, typically a commercial bank, matches up institutions using a telecommunications network that links federal funds brokers with participating institutions. Upon maturity of the fed funds loan, the borrowing bank's fed funds demand deposit account at the lending bank is debited for the total value of the loan and the borrowing bank pays the lending bank an interest payment for the use of the fed funds. Most of these fed funds transactions are for more than $5 million (they averaged around $45 million in the early 2000s) and usually have a one- to seven-day maturity.

idle funds to buy T-bills from its bank. The bank then agrees to repurchase the T-bills in the future at a higher price. However, most repos are collateralized fed funds transactions entered into by banks. As discussed above, in a fed funds transaction, the bank with excess reserves sells fed funds for one day to the purchasing bank. The next day, the purchasing bank returns the fed funds plus one day's interest reflecting the fed funds rate. Since there is a credit risk exposure to the selling bank in that the purchasing bank may be unable to repay the fed funds the next day, the selling bank may seek collateral backing for the one-day loan of fed funds. In a repo transaction, the funds-selling bank receives government securities as collateral from the funds-purchasing bank. That is, the funds-purchasing bank temporarily exchanges securities for cash. The next day, this transaction is reversed, with the funds-purchasing bank sending back the fed funds borrowed plus interest (the repo rate); it receives in return, or repurchases, its securities used as collateral in the transaction.

The Trading Process for Repurchase Agreements. Repurchase agreements are arranged either directly between two parties or with the help of brokers and dealers. Figure 5–4 illustrates a $75 million repurchase agreement of Treasury bonds arranged directly between two parties (e.g., J.P. Morgan Chase and Bank of America). The repo buyer, J.P. Morgan Chase, arranges to purchase T-bonds from the repo seller, Bank of America, with an agreement that the seller will repurchase the T-bonds within a stated period of time—one day. In most repurchase agreements, the repo buyer acquires title to the securities for the term of the agreement.

Once the transaction is agreed upon, the repo buyer, J.P. Morgan Chase, instructs its district Federal Reserve Bank (the FRBNY) to transfer $75 million in excess reserves, via Fedwire, to the repo seller's reserve account. The repo seller, Bank of America, instructs its district Federal Reserve Bank (the FRB of San Francisco) to transfer $75 million from its T-bond account via securities Fedwire to the repo buyer's T-bond account. Upon maturity of the repo (one day in this example), these transactions are reversed. In addition, the repo

FIGURE 5–4 A Repurchase Agreement Transaction



seller transfers additional funds (representing one day's interest) from its reserve account to the reserve account of the repo buyer.

As noted in Chapter 4, repurchase agreements are used by the Federal Reserve to help it conduct open market operations as part of its overall monetary policy strategy. When monetary adjustments are intended to be temporary (such as smoothing out fluctuations in interest rates or the money supply), the Fed uses repurchase agreements with dealers or banks. The maturities of the repos used by the Federal Reserve are rarely longer than 15 days. Government securities dealers—such as the largest investment and commercial banks—engage in repos to manage their liquidity and to take advantage of anticipated changes in interest rates.

Repurchase Agreement Yields. Because Treasury securities back repurchase agreements, they are low credit risk investments and have lower interest rates than uncollateralized fed funds.[9] The spread between the rate on collateralized repos versus uncollateralized fed funds has usually been in the order of 0.25 percent, or 25 basis points. The yield on repurchase agreements is calculated as the annualized percentage difference between the initial selling price of the securities and the contracted (re)purchase price (the selling price plus interest paid on the repurchase agreement), using a 360-day year. Specifically:

$$i_{RA} = \frac{P_f - P_0}{P_0} \times \frac{360}{h}$$

where

P_f = Repurchase price of the securities (equals the selling price plus interest paid on the repurchase agreement)
P_0 = Selling price of the securities
h = Number of days until the repo matures

EXAMPLE 5–7 Calculation of a Yield on a Repurchase Agreement

Suppose a bank enters a reverse repurchase agreement in which it agrees to buy Treasury securities from one of its correspondent banks at a price of $10,000,000, with the promise to sell these securities back at a price of $10,002,986 ($10,000,000 plus interest of $2,986) after five days. The yield on this repo to the bank is calculated as follows:

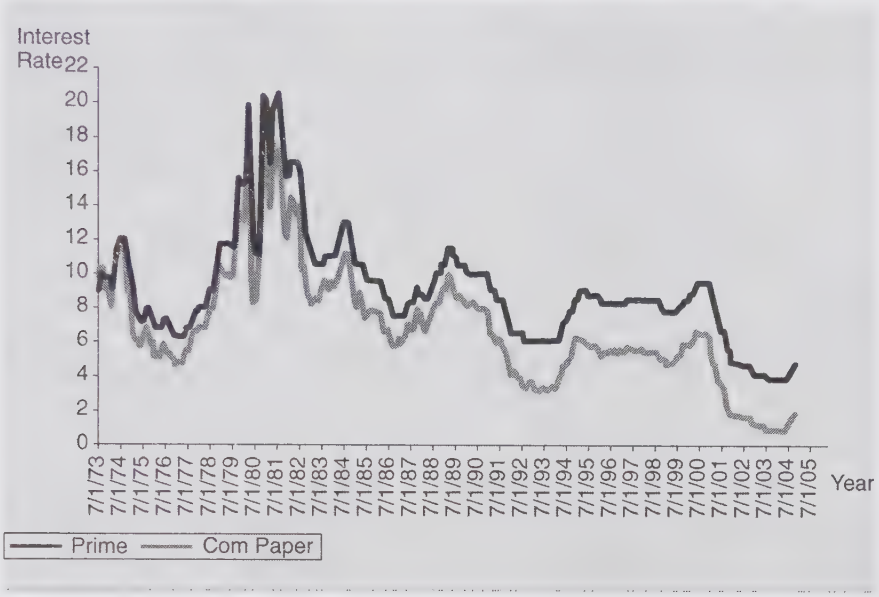
$$i_{RA} = \frac{\$10{,}002{,}986 - \$10{,}000{,}000}{\$10{,}000{,}000} \times \frac{360}{5} = 2.15\%$$

Because of their common use as a source of overnight funding and the fact that repos are essentially collateralized fed funds, the Federal Reserve generally classifies federal funds and repurchase agreements together in its statistical data. Together, these amounted to $1,585.1 billion outstanding in 2004 (see Table 5–3).

Some notable differences exist, however, between repurchase agreements and fed funds. For example, repurchase agreements are less liquid than fed funds since they can only be arranged after an agreed upon type of collateral is posted (i.e., repos are hard to arrange at the close of the banking day, whereas fed funds can be arranged at very short notice, even a few minutes). Further, nonbanks are more frequent users of repurchase agreements.

9. There is a one-day interest rate risk that may impact credit risk if interest rates suddenly rise so that the market value of the collateral backing the repo falls. To avoid the risk many repo transactions require a securities "haircut" to be imposed at the time of the transaction—more securities are used to back the cash part of the transaction. For example, Bank A may send $100 million in cash to Bank B. In turn, Bank B sends $105 million in securities as collateral to back the cash loan from A.

FIGURE 5–5 Commercial Paper and Prime Rate, 1973–2004



Source: Federal Reserve Board Web site, "Selected Interest Rates," November 2004. **www.federalreserve.gov**

Commercial Paper

commercial paper
An unsecured short-term promissory note issued by a company to raise short-term cash, often to finance working capital requirements.

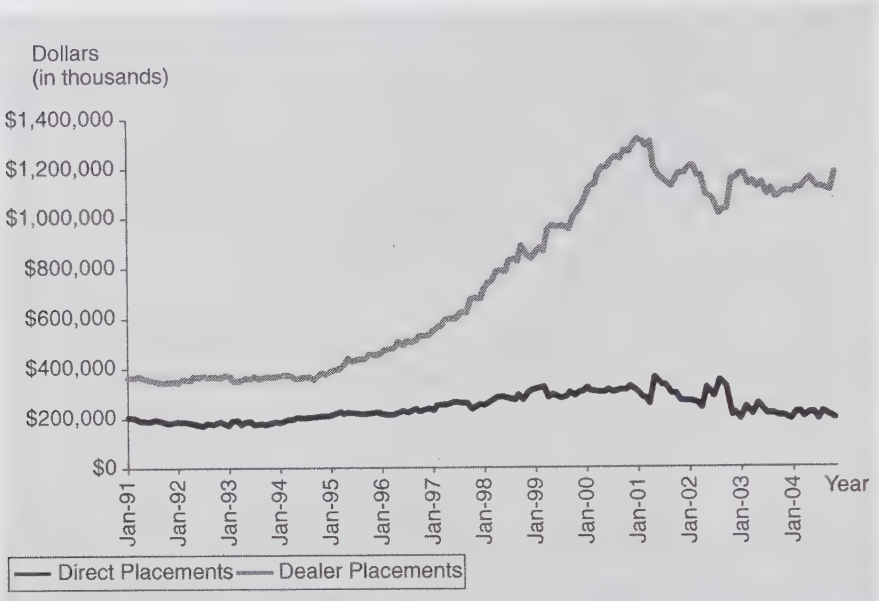
Commercial paper is an unsecured short-term promissory note issued by a corporation to raise short-term cash, often to finance working capital requirements. Commercial paper is the largest (in terms of dollar value outstanding) of the money market instruments, with $1,309.7 billion outstanding as of 2004. One reason for such large amounts of commercial paper outstanding is that companies with strong credit ratings can generally borrow money at a lower interest rate by issuing commercial paper than by directly borrowing (via loans) from banks. Indeed, although business loans were the major asset on bank balance sheets between 1965 and 1990, they have dropped in importance since 1990. This trend reflects the growth of the commercial paper market. Figure 5–5 illustrates the difference between commercial paper rates and the prime rate for borrowing from banks from 1973 through November 2004.[10] Notice that in the late 1990s, as the U.S. economy thrived and default risk on the highest quality borrowers decreased, the spread between the prime rate and commercial paper rate increased.

Commercial paper is generally sold in denominations of $100,000, $250,000, $500,000, and $1 million. Maturities generally range from 1 to 270 days—the most common maturities are between 20 and 45 days. This 270-day maximum is due to a Securities and Exchange Commission (SEC) rule that securities with a maturity of more than 270 days must go through the time-consuming and costly registration process to become a public debt offering (i.e., a corporate bond). Commercial paper can be sold directly by the issuers to a buyer such as a mutual fund (a direct placement) or can be sold indirectly by dealers in the commercial paper market. The dollar value (in thousands of dollars) of each method of issue from 1991 through November 2004, is reported in Figure 5–6.

www.sec.gov

10. It should be noted, however, that the best borrowers from banks can borrow below prime. Prime rate in today's banking world is viewed as a rate to be charged to an average borrower—best borrowers pay prime rate minus some spread.

FIGURE 5–6 Direct versus Dealer Placements of Commercial Paper



Source: Federal Reserve Board Web site, "Research and Data," November 2004. **www.federalreserve.gov**

Commercial paper is generally held by investors from the time of issue until maturity. Thus, there is no active secondary market for commercial paper.[11] Because commercial paper is not actively traded and because it is also unsecured debt, the credit rating of the issuing company is of particular importance in determining the marketability of a commercial paper issue. Credit ratings provide potential investors with information regarding the ability of the issuing firm to repay the borrowed funds, as promised, and to compare the commercial paper issues of different companies. Several credit rating firms rate commercial paper issues (e.g., Standard & Poor's, Moody's, and Fitch IBCA, Inc.). Standard & Poor's rates commercial paper from A-1 for highest quality issues to D for lowest quality issues, while Moody's rates commercial paper from P-1 for highest quality issues to "not rated" for lowest quality issues. Virtually all companies that issue commercial paper obtain ratings from at least one rating services company, and most obtain two rating evaluations.

www.standardandpoors.com

www.moodys.com

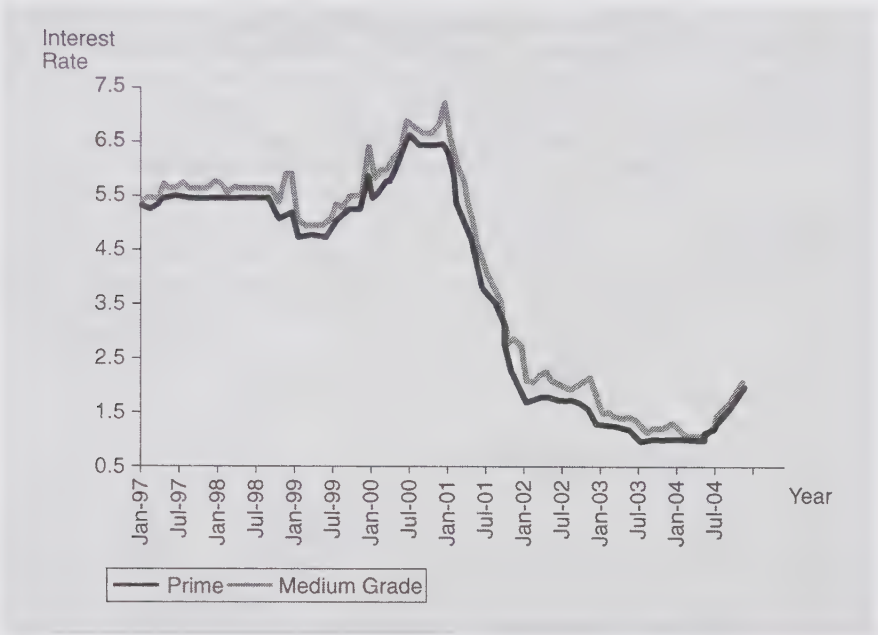
In the early 2000s, the slowdown in the U.S. economy resulted in ratings downgrades for some of the largest commercial paper issuers. For example, the downgrade of General Motors and Ford from a tier-one to tier-two commercial paper issuer had a huge impact on the commercial paper markets. Tyco International, another major commercial paper issuer, fell from a tier-one to a tier-three issuer, a level for which there is virtually no demand. The result is that these commercial paper issuers were forced to give up the cost advantage of commercial paper and to move to the long-term debt markets to ensure they have access to cash. Thus, while still the largest money market instrument outstanding, the decrease in the number of eligible commercial paper issuers in the early 2000s resulted in a decrease in the size of the commercial paper market for the first time in 40 years.[12] This decrease can be seen in Figure 5–6.

The better the credit rating on a commercial paper issue, the lower the interest rate on the issue. The spread between the interest rate on medium grade commercial paper and prime grade commercial paper is shown in Figure 5–7. During the 1990s, the spread was generally

11. This is partly because any dealer that issues (underwrites) commercial paper of a given company will generally buy back that commercial paper should a buyer wish to sell it. Thus, in general, underwriters act as counterparties in any secondary market trade.

12. See "Falling Short," *The Economist*, March 30, 2002, pp. 65–66.

FIGURE 5–7 Rates on Prime versus Medium Grade Commercial Paper, 1997–2004



Source: Federal Reserve Board Web site, "Research and Data," November 2004. **www.federalreserve.gov**

on the order of 0.22 percent (22 basis points) per year. From June 2001 through June 2003, as the economy slowed, the spread increased to an average of 0.38 percent per year.

Commercial paper issuers with lower than prime credit ratings often back their commercial paper issues with a line of credit obtained from a commercial bank. In these cases, the bank agrees to make the promised payment on the commercial paper if the issuer cannot pay off the debt on maturity. Thus, a letter of credit backing commercial paper effectively substitutes the credit rating of the issuer with the credit rating of the bank. This reduces the risk to the purchasers of the paper and results in a lower interest rate (and high credit rating) on the commercial paper. In other cases, an issuer arranges a line of credit with a bank (a loan commitment) and draws on this line if it has insufficient funds to meet the repayment of the commercial paper issue at maturity. As commercial paper issuers' credit ratings fell with the downturn in the economy in the early 2000s, however, banks found these previously low-risk standby letters of credit to be less attractive. Banks tended to provide these letters of credit only if the customer also promised to use the bank for other, more lucrative business opportunities (e.g., loans).

The Trading Process for Commercial Paper. Commercial paper is sold to investors either directly (about 15 percent of all issues in 2004—see Figure 5–6), using the issuer's own sales force (e.g., GMAC), or indirectly through brokers and dealers (about 85 percent of all issues in 2004), such as major bank subsidiaries that specialize in investment banking activities (so-called Section 20 subsidiaries) and investment banks underwriting the issues.[13] Commercial paper underwritten and issued through brokers and dealers is more expensive to the issuer, usually increasing the cost of the issue by one-tenth to one-eighth of a percent, reflecting an underwriting cost. In return, the dealer guarantees, through a firm commitment underwriting, the sale of the whole issue. To help achieve this goal, the dealer contacts prospective buyers of the commercial paper, determines the appropriate discount rate on the

13. Commercial bank subsidiaries have been allowed to underwrite commercial paper only since 1987.

commercial paper, and relays any special requests for the commercial paper in terms of specific quantities and maturities to the issuer. When a company issues commercial paper through a dealer, a request made at the beginning of the day by a potential investor (such as a money market mutual fund) for a particular maturity is often completed by the end of the day.

When commercial paper is issued directly from an issuer to a buyer, the company saves the cost of the dealer (and the underwriting services) but must find appropriate investors and determine the discount rate on the paper that will place the complete issue. When the firm decides how much commercial paper it wants to issue, it posts offering rates to potential buyers based on its own estimates of investor demand. The firm then monitors the flow of money during the day and adjusts its commercial paper rates depending on investor demand.

Commercial Paper Yields. Like Treasury bills, yields on commercial paper are quoted on a discount basis—the discount return to commercial paper holders is the annualized percentage difference between the price paid for the paper and the par value using a 360-day year. Specifically:

$$i_{cp}(dy) = \frac{P_f - P_0}{P_f} \times \frac{360}{h}$$

and when converted to a bond equivalent yield:

$$i_{cp}(bey) = \frac{P_f - P_0}{P_0} \times \frac{365}{h}$$

EXAMPLE 5-8 Calculation of the Yield on Commercial Paper

Suppose an investor purchases 95-day commercial paper with a par value of $1,000,000 for a price of $994,854. The discount yield (*dy*) on the commercial paper is calculated as:

$$i_{cp}(dy) = \frac{\$1{,}000{,}000 - \$994{,}854}{\$1{,}000{,}000} \times \frac{360}{95} = 1.95\%$$

and the bond equivalent yield (*bey*) is:

$$i_{cp}(bey) = \frac{\$10{,}000{,}000 - \$994{,}854}{994{,}854} \times \frac{365}{95} = 1.99\%$$

Negotiable Certificates of Deposits

negotiable certificate of deposit

A bank-issued, fixed maturity, interest-bearing time deposit that specifies an interest rate and maturity date and is negotiable.

bearer instrument

An instrument in which the holder at maturity receives the principal and interest.

A **negotiable certificate of deposit** (CD) is a bank-issued time deposit that specifies an interest rate and maturity date and is negotiable (i.e., salable) in the secondary market. As of December 2004, there were $1,379.4 billion of negotiable CDs outstanding. A negotiable CD is a **bearer instrument**—whoever holds the CD when it matures receives the principal and interest. A negotiable CD can be traded any number of times in secondary markets; therefore, the original buyer is not necessarily the owner at maturity.[14] Negotiable CDs have denominations that range from $100,000 to $10 million; $1 million is the most common denomination. The large denominations make negotiable CDs too large for most individuals to buy. However, negotiable CDs are often purchased by money market mutual funds (see Chapter 17), which pool funds of individual investors and allow this group to indirectly purchase negotiable CDs. Negotiable CD maturities range from two weeks to one year, with most having a maturity of one to four months.

14. By contrast, retail CDs with face values under $100,000 are not traded. Thus, a negotiable CD is more "liquid" to an investor than a retail CD or time deposit.

While CDs have been used by banks since the early 1900s, they were not issued in a negotiable form until the early 1960s. Because of rising interest rates in the 1950s and significant interest rate penalties charged on the early withdrawal of funds invested in CDs, large CDs became unattractive to deposit holders. The result was a significant drop in deposits at banks (disintermediation). In 1961, First National City Bank of New York (now known as Citigroup) issued the first negotiable CD, and money market dealers agreed to make a secondary market in them. These negotiable CDs were well received and helped banks regain many of their lost deposits. Indeed, the success of negotiable CDs helped bank managers focus more actively on managing the liability side of their portfolios (see Chapter 21).

The Trading Process for Negotiable Certificates of Deposit. Banks issuing negotiable CDs post a daily set of rates for the most popular maturities of their negotiable CDs, normally 1, 2, 3, 6, and 12 months. Then, subject to its funding needs, the bank tries to sell as many CDs to investors who are likely to hold them as investments rather than sell them to the secondary market.

In some cases, the bank and the CD investor directly negotiate a rate, the maturity, and the size of the CD. Once this is done, the issuing bank delivers the CD to a custodian bank specified by the investor. The custodian bank verifies the CD, debits the amount to the investor's account, and credits the amount to the issuing bank. This is done through the Fedwire system by transferring fed funds from the custodian bank's reserve account at the Fed to the issuing bank's reserve account.

The secondary market for negotiable CDs allows investors to buy existing negotiable CDs rather than new issues. While it is not a very active market, the secondary market for negotiable CDs is made up of a linked network of approximately 15 brokers and dealers using telephones to transact. The secondary market is predominantly located in New York City, along with most of the brokers and dealers.

The mechanics of the secondary market are similar to those of the primary market for negotiable CDs. Certificates are physically transported between traders or their custodian banks. The custodian bank verifies the certificate and records the deposit in the investor's account. Most transactions executed in the morning are usually settled the same day; most transactions executed later in the day are settled the next business day.

Negotiable CD Yields. Negotiable CD rates are negotiated between the bank and the CD buyer. Large, well-known banks can offer CDs at slightly lower rates than smaller, less well-known banks. This is due partly to the lower perceived default risk and greater marketability of well-known banks and partly to the belief that larger banks are often "too big to fail"—regulators will bail out troubled large banks and protect large depositors beyond the explicit ($100,000) deposit cap under the current FDIC insurance program (see Chapter 13). Interest rates on negotiable CDs are generally quoted on an interest-bearing basis using a 360-day year. CDs with a maturity of more than one year generally pay interest semiannually.

EXAMPLE 5–9 Calculation of the Secondary Market Value of a Negotiable CD

A bank has issued a 6-month, $1 million negotiable CD with a 4.1 percent annual interest rate. Thus, the CD holder will receive:

$$FV = \$1\text{m}.(1 + .041/2) = \$1{,}020{,}500$$

in six months in exchange for $1 million deposited in the bank today.

Immediately after the CD is issued, the market rate on the $1 million CD rises to 4.6 percent. As a result, the secondary market price of the $1 million face value CD decreases as follows:

$$PV = 1{,}020{,}500/(1 + .046/2) = \$997{,}556$$

Banker's Acceptances

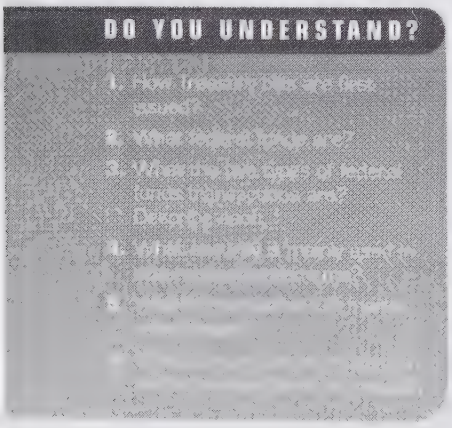
banker's acceptance
A time draft payable to a seller of goods, with payment guaranteed by a bank.

A **banker's acceptance** is a time draft payable to a seller of goods, with payment guaranteed by a bank. There were $4.4 billion banker's acceptances outstanding in 2004. Time drafts issued by a bank are orders for the bank to pay a specified amount of money to the bearer of the time draft on a given date.

The Trading Process for Banker's Acceptances. Many banker's acceptances arise from international trade transactions and the underlying letters of credit (or time drafts) that are used to finance trade in goods that have yet to be shipped from a foreign exporter (seller) to a domestic importer (buyer). Foreign exporters often prefer that banks act as guarantors for payment before sending goods to domestic importers, particularly when the foreign supplier has not previously done business with the domestic importer on a regular basis. In the United States, a majority of all acceptances are originated in New York, Chicago, and San Francisco. The U.S. bank insures the international transaction by stamping "Accepted" on a time draft written against the letter of credit between the exporter and the importer, signifying its obligation to pay the foreign exporter (or its bank) on a specified date should the importer fail to pay for the goods. Foreign exporters can then hold the banker's acceptance (the accepted time draft written against the letter of credit) until the date specified on the letter of credit. If they have an immediate need for cash, they can sell the acceptance before that date at a discount from the face value to a buyer in the money market (e.g., a bank). In this case, the ultimate bearer will receive the face value of the banker's acceptance on maturity. We describe this process in more detail in Appendix B to this chapter located at the book's Web site (**www.mhhe.com/sc3e**).

Because banker's acceptances are payable to the bearer at maturity, they can and are traded in secondary markets. Maturities on banker's acceptances traded in secondary markets range from 30 to 270 days. Denominations of banker's acceptances are determined by the size of the original transaction (between the domestic importer and the foreign exporter). Once in the secondary markets, however, banker's acceptances are often bundled and traded in round lots, mainly of $100,000 and $500,000.

Only the largest U.S. banks are active in the banker's acceptance market. Because the risk of default is very low (essentially an investor is buying a security that is fully backed by commercial bank guarantees), interest rates on banker's acceptances are low. Specifically, there is a form of double protection underlying banker's acceptances that reduces their default risk. Since both the importer and the importer's bank must default on the transaction before the investor is subject to risk, the investor is also protected by the value of the goods imported to which he or she now has a debtor's claim—the goods underlying the transaction can be viewed as collateral. Like T-bills and commercial paper, banker's acceptances are sold on a discounted basis.



Comparison of Money Market Securities

Having reviewed the different money market securities, it should be obvious that the different securities have a number of characteristics in common: large denominations, low default risk, and short maturities. It should also be noted that these securities are quite different in terms of their liquidity. For example, Treasury bills have an extensive secondary market. Thus, these money market securities can be converted into cash quickly and with little loss in value. Commercial paper, on the other hand, has no organized secondary market. These cannot be converted into cash quickly unless resold to the original dealer/underwriter, and conversion may involve a relatively higher cost. Federal funds also have no secondary market trading, since they are typically overnight loan transactions and are not intended as investments to be held beyond very short horizons (thus, the lack of a secondary market is inconsequential). Indeed, longer-horizon holders simply roll over their holdings or, in the case of those in need of liquidity, simply do not renew their fed funds loans. Bank negotiable CDs can also be traded on secondary markets, but in recent years trading has been relatively inactive, as most negotiable

CDs are being bought by "buy and hold" oriented money market mutual funds, as are banker's acceptances.

4 MONEY MARKET PARTICIPANTS

The major money market participants are the U.S. Treasury, the Federal Reserve, commercial banks, money market brokers and dealers, corporations, and other financial institutions such as mutual funds. Table 5–6 summarizes the role (issuer or investor) each of these participants plays in the markets for the various money market securities.

The U.S. Treasury

www.ustreas.gov

The U.S. Treasury raises significant amounts of funds in the money market when it issues T-bills. T-bills are the most actively traded of the money market securities. T-bills allow the U.S. government to raise money to meet unavoidable short-term expenditure needs prior to the receipt of tax revenues. Tax receipts are generally concentrated around quarterly dates, but government expenditures are more evenly distributed over the year.

The Federal Reserve

www.federalreserve.gov

The Federal Reserve is a key (arguably the most important) participant in the money markets. The Federal Reserve holds T-bills (as well as T-notes and T-bonds) to conduct open market transactions—purchasing T-bills when it wants to increase the money supply, and selling T-bills when it wants to decrease the money supply. The Federal Reserve often uses

TABLE 5–6 Money Market Participants

Instrument	Principal Issuer	Principal Investor
Treasury bills	U.S. Treasury	Federal Reserve System Commercial banks Mutual funds Brokers and dealers Other financial institutions Corporations
Federal funds Repurchase agreement	Commercial banks Federal Reserve System Commercial banks Brokers and dealers Other financial institutions	Commercial banks Federal Reserve System Commercial banks Mutual funds Brokers and dealers Other financial institutions Corporations
Commercial paper	Commercial banks Other financial institutions Corporations	Brokers and dealers Mutual funds Corporations Other financial institutions
Negotiable CDs	Commercial banks	Brokers and dealers Mutual funds Corporations Other financial institutions
Banker's acceptances	Commercial banks	Commercial banks Brokers and dealers Corporations

repurchase agreements and reverse repos to temporarily smooth interest rates and the money supply. Moreover, the Fed targets the federal funds rate as part of its overall monetary policy strategy, which can in turn affect other money market rates. Finally, the Fed operates the discount window, which it can use to influence the supply of bank reserves to commercial banks and ultimately the demand for and supply of fed funds and repos.

Commercial Banks

Commercial banks are the most diverse group of participants in the money markets. As Table 5–6 shows, banks participate as issuers and/or investors of almost all money market instruments discussed above. For example, banks are the major issuers of negotiable CDs, banker's acceptances, federal funds, and repurchase agreements.

The importance of banks in the money markets is driven in part by their need to meet reserve requirements imposed by regulation. For example, during periods of economic expansion, heavy loan demand can produce reserve deficiencies for banks (i.e., their actual reserve holdings are pushed below the minimums required by regulation). Additional reserves can be obtained by borrowing fed funds from other banks, engaging in a repurchase agreement, selling negotiable CDs, or selling commercial paper.[15] Conversely, during contractionary periods, many banks have excess reserves that they can use to purchase Treasury securities, trade fed funds, engage in a reverse repo, and so on.

Money Market Mutual Funds

Money market mutual funds purchase large amounts of money market securities and sell shares in these pools based on the value of their underlying (money market) securities (see Chapter 17). In doing so, money market mutual funds allow small investors to invest in money market instruments. At the end of 2004, money market mutual funds had $1,912.3 billion invested in short-term financial securities—such as repurchase agreements, negotiable CDs, open market paper (mostly commercial paper), and U.S. government securities. Money market mutual funds provide an alternative investment opportunity to interest-bearing deposits at commercial banks.[16]

Brokers and Dealers

Brokers' and dealers' services are important to the smooth functioning of money markets. We have alluded to various categories of brokers and dealers in this chapter. First are the 22 primary government security dealers. This group of participants plays a key role in marketing new issues of Treasury bills (and other Treasury securities). Primary government securities dealers also make the market in Treasury bills, buying securities from the Federal Reserve when they are issued and selling them in the secondary market. Secondary market transactions in the T-bill markets are transacted in the trading rooms of these primary dealers. These dealers also assist the Federal Reserve when it uses the repo market to temporarily increase or decrease the supply of bank reserves available.

The second group of brokers and dealers are money and security brokers. The five major brokers in this group are Cantor Fitzgerald Securities Corp., Garban-Intercapital, Liberty, RMJ Securities Corp., and Hill Farber. When government securities dealers trade with each other, they often use this group of brokers as intermediaries. These brokers also play a major role in linking buyers and sellers in the fed funds market and assist secondary trading in

15. Only bank holding companies such as Citigroup can issue commercial paper. However, funds so borrowed can be lent (downstreamed) to bank subsidiaries such as Citibank. Currently, the Federal Reserve imposes reserve requirements on such transactions.

16. Indeed, the short maturity of these asset holdings is an objective of these funds so as to retain the depositlike nature of their liabilities (called shares). The major difference between deposits and money market mutual fund (MMMF) shares is that interest-bearing deposits (below $100,000) are fully insured by the FDIC, whereas MMMF shares are not. Moreover, because of bank regulatory costs (such as reserve requirements, capital adequacy requirements, and deposit insurance premiums), bank deposits generally offer lower interest rates or returns than noninsured money market mutual funds. Thus, the net gain in switching to a money market mutual fund is a higher return in exchange for the loss of FDIC deposit insurance coverage. Many investors appeared willing to give up FDIC insurance coverage to obtain additional returns in the late 1990s and early 2000s.

other money market securities as well. These brokers never trade for their own account, and they keep the names of dealers involved in trades they handle confidential.

The third group of brokers and dealers are the thousands of brokers and dealers who act as intermediaries in the money markets by linking buyers and sellers of money market securities (see Chapter 16). This group of brokers and dealers often act as the intermediaries for smaller investors who do not have sufficient funds to invest in primary issues of money market securities or who simply want to invest in the money markets.

Corporations

Nonfinancial and financial corporations raise large amounts of funds in the money markets, primarily in the form of commercial paper. The volume of commercial paper issued by corporations has been so large that there is now more commercial paper outstanding than any other type of money market security. Because corporate cash inflows rarely equal their cash outflows, they often invest their excess cash funds in money market securities, especially T-bills, repos, commercial paper, negotiable CDs, and banker's acceptances.

Other Financial Institutions

Because their liability payments are relatively unpredictable, property-casualty (PC) insurance companies, and to a lesser extent life insurance companies, must maintain large balances of liquid assets (see Chapter 15). To accomplish this, insurance companies invest heavily in highly liquid money market securities, especially T-bills, repos, commercial paper, and negotiable CDs.

Since finance companies are not banks and cannot issue deposits, they raise large amounts of funds in the money markets (see Chapter 14), especially through the issuance of commercial paper.

DO YOU UNDERSTAND?

INTERNATIONAL ASPECTS OF MONEY MARKETS

While U.S. money markets are the largest and most active in the world, money markets across the world have been growing in size and importance. Two forms of growth include (1) U.S. money market securities bought and sold by foreign investors and (2) foreign money market securities. In conjunction with this increased worldwide interest in U.S. money market securities, some of the largest U.S. financial institutions that trade in money markets for themselves and their customers have opened offices in London, Tokyo, and beyond, most recently through mergers and acquisitions. For example, in October 2003 Citigroup acquired 5 percent of Shanghai Pudong Development Bank, China's ninth-largest commercial bank, which has a network of 270 outlets across the country's major metropolitan areas, with the option of increasing its stake in the future.

As a result of the growth in money markets worldwide, the flow of funds across borders in various countries has grown as international investors move their funds to money markets offering the most attractive yields. Table 5–7 lists the total amounts of various U.S. money market securities held by foreign investors from 1994 through 2004. Figure 5–8 shows the U.S. dollar equivalent amounts of money market instruments traded in international money markets as of June 2004, by the currency of issue and type of instrument issued. Table 5–8 shows the variation in central bank interest rates (discount rates for lender of last resort loans) in several countries in 2004.

Euro Money Markets

Because of the importance of the U.S. dollar relative to other currencies, many international financial contracts call for payment in U.S. dollars—the U.S. dollar is still the major international medium of exchange. As a result, foreign governments and businesses have historically held a store of funds (deposits) denominated in dollars outside of the United States. Further, U.S. corporations conducting international trade often

TABLE 5-7 Foreign Investments in U.S. Money Market Instruments
(in billions of dollars)

	1996	1997	2003	2004
Treasury securities[†]	$632.6	$1,251.8	$1,222.0	$1,805.1
Repurchase agreements	46.6	90.8	91.3	552.0
Negotiable CDs	56.3	73.6	107.2	165.4
Open market paper[‡]	24.9	77.8	111.0	115.5

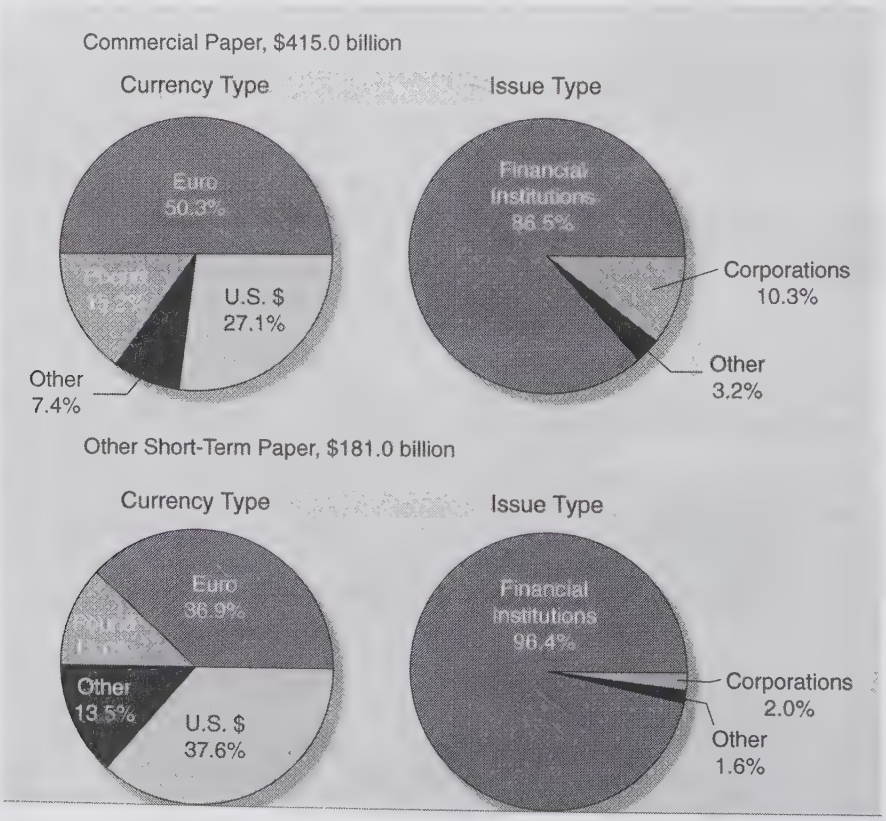
[†]Includes Treasury bills, notes, and bonds.
[‡]Commercial paper and banker's acceptances.
Source: Federal Reserve Board Web site, "Flow of Fund Accounts," September 2004. **www.federalreserve.gov**

DO YOU UNDERSTAND?

hold U.S. dollar deposits in foreign banks overseas to facilitate expenditures and purchases. These dollar-denominated deposits held offshore in U.S. bank branches overseas and in other (foreign) banks are called Eurodollar deposits (Eurodollar CDs) and the market in which they trade is called the **Eurodollar market.** Eurodollars may be held by governments, corporations, and individuals from anywhere in the world and are not directly subject to U.S. bank regulations, such as reserve requirements and deposit insurance premiums (or protection). As a result, the rate

Eurodollar market
The market in which Eurodollars trade.

FIGURE 5-8 Worldwide Money Market Instruments Outstanding



Source: Bank for International Settlements, "International Banking and Financial Market Developments," *Quarterly Review,* September 2004. **www.bis.org**

TABLE 5–8 Selected Central Bank Interest Rates

	New Rate		Previous Rate	
Country/Discount Rate	Percent Per Year	Applicable From	Percent Per Year	Applicable From
1. EU countries				
Euro area	2	June '03	2.5	Mar. '03
Denmark				
Discount rate	2	June '03	2.15	Mar. '03
Sweden				
Deposit rate	1¾	Nov. '04	1¼	July '04
Repurchase rate	2.5	Nov. '04	2.0	July '04
United Kingdom				
Repurchase rate†	4.75	Aug. '04	4½	June '04
2. Switzerland				
Three-month LIBOR target	¼–1¼	Sep. '04	0–1	June '04
3. Non-European countries				
Canada‡				
Discount rate	2½	Oct. '04	2¼	Sep. '04
Japan				
Discount rate	0.10	Sep. '01	0.25	Mar. '01
United States				
Federal funds rate§	2	Nov. '04	1.75	Sep. '04

†Bank of England key rate.

‡Bank of Canada's ceiling rate for call money.

§Rate targeted for interbank trade in central bank money.

Source: Author's research.

paid on Eurodollar CDs is generally higher than that paid on U.S.-domiciled CDs (see below). As an alternative to the Eurodollar market, companies can also obtain short-term funding by issuing Eurocommercial paper. Eurocommercial paper is issued in Europe but can be held by investors inside or outside of Europe.

The Eurodollar Market. Large banks in London organized the interbank Eurodollar market. This market is now used by banks around the world as a source of overnight funding. The term "Eurodollar market" is something of a misnomer because the markets have no true physical location. Rather, the Eurodollar market is simply a market in which dollars held outside the United States (so-called Eurodollars) are tracked among multinational banks, including the offices of U.S. banks abroad, such as Citigroup's branch in London or its subsidiary in London.[17] For example, a company in Italy needing U.S. dollars for a foreign trade transaction might ask Citigroup's subsidiary in London to borrow these dollars on the Eurodollar market. Alternatively, a Greek bank needing U.S. dollar funding may raise the required funds by issuing a Eurodollar CD. Most Eurodollar transactions take place in London.

London Interbank Offered Rate (LIBOR)

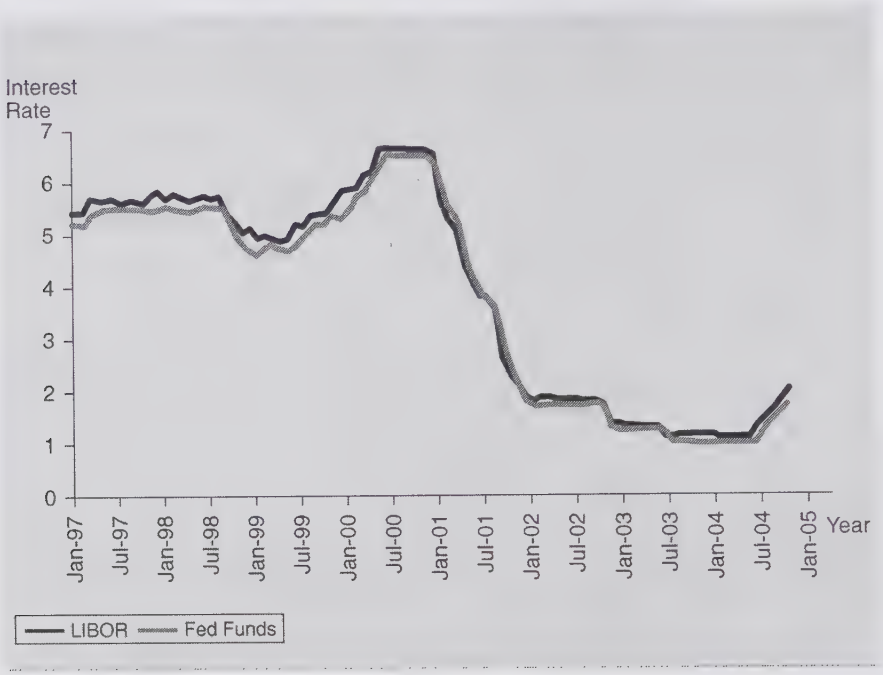
The rate paid on Eurodollars.

The rate offered for sale on Eurodollar funds is known as the **London Interbank Offered Rate (LIBOR).** Funds traded in the Eurodollar market are often used as an alternative to fed funds as a source of overnight funding for banks.[18] As alternative sources of overnight funding, the LIBOR and U.S. federal funds rate tend to be very closely related. Should rates in one of these markets (e.g., the LIBOR market) decrease relative to the other

17. Estimates indicate that more than twice as many dollars are traded outside than within U.S. borders.

18 Also, the rate paid by banks buying these funds is the London Interbank Bid Rate (LIBID). The spread between LIBOR and LIBID is small, rarely exceeding 12.5 basis points.

FIGURE 5–9 Overnight Interest Rates, 1997–2004



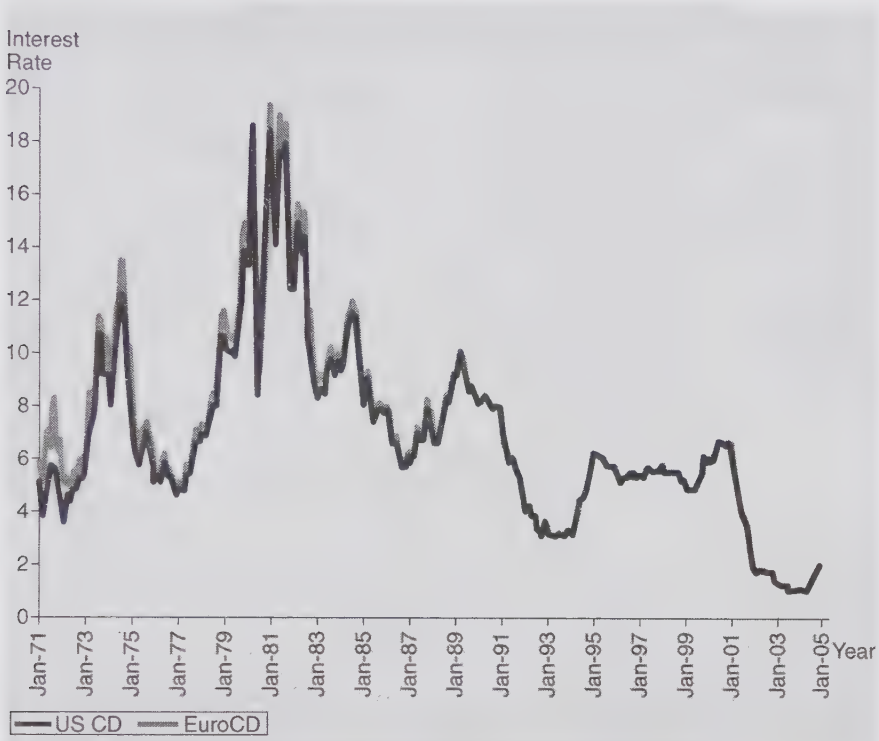
Source: Fannie Mae Web site, November 2004. **www.fanniemae.com**

(e.g., the fed funds market), overnight borrowers will borrow in the LIBOR market rather than the fed funds market. As a result, the LIBOR will increase with this increased demand and the fed funds rate will decrease with the decline in demand. This will make the difference between the two rates quite small, although not equal, as is discussed below. The ease of transacting in both markets makes it virtually costless to use one market versus the other. Indeed, the LIBOR rate is frequently used by major banks in the United States as a base rate on commercial and industrial loans.

While they are close substitutes for overnight funding, the fed funds rate is generally lower than the LIBOR. This difference is due to the low-risk nature of U.S. bank deposits versus foreign bank deposits. U.S. bank deposits are covered by deposit insurance up to certain levels. Moreover, there is a perception that large U.S. bank depositors and large U.S. banks are implicitly insured via a "too big to fail" (or TBTF) guarantee. Such guarantees lower U.S. bank risk and thus the cost of borrowing in the fed funds market. Foreign banks have no such explicit or implicit guarantees. As a result, LIBOR is generally higher than the fed funds rate, reflecting slightly higher default risk. The fed funds rate and LIBOR between 1997 and 2004 are plotted in Figure 5–9. The spread of the LIBOR over the fed funds rate averaged 0.12 percent over the early part of this period (1997–1999), and the correlation between the movements in the two rates was 92 percent. After 1999 the spread was only 0.01 percent and the fed funds rate sometimes exceeded the LIBOR rate after July 2001. As noted above, the increased demand for Eurodollars relative to fed funds as a source of overnight funding has, at times, outweighed the effect of the deposit insurance and TBTF guarantees. The result is that the fed funds rate has, at times, risen above the LIBOR rate. The correlation between the movement in the two rates was 95 percent after 1999.

Initially, most short-term adjustable-rate business loans were tied to the U.S. fed funds rate. However (as seen below), the tremendous growth of the Eurodollar market has resulted in the LIBOR becoming the standard rate by which loan rates are now priced. For example,

FIGURE 5–10 Three-Month U.S. Bank Issued versus Eurodollar CD Rates, 1971–2004



Source: Federal Reserve Board Web site, "Research and Data," November 2004. **www.federalreserve.com**

Eurodollar CDs
Dollar-denominated deposits in non-U.S. banks.

the commercial paper market in the United States now quotes rates as a spread over the LIBOR rate rather than over the Treasury bill rate.

Eurodollar Certificates of Deposit. **Eurodollar certificates of deposits** (CDs) are U.S. dollar–denominated CDs in foreign banks. Maturities on Eurodollar CDs are less than one year, and most have a maturity of one week to six months. Because these securities are deposited in non-U.S. banks, Eurodollar CDs are not subject to reserve requirements in the same manner as U.S. deposits (although the reserve requirement on U.S. CDs was set to zero at the beginning of 1991).

DO YOU UNDERSTAND?

1. What is the difference between a Eurodollar CD and a U.S. CD?

Figure 5–10 shows the difference between three-month Eurodollar and U.S. bank issued–CDs from 1971 through 2004. As can be seen in this figure, prior to the 1990s, the Eurodollar CD paid consistently higher interest rates than U.S. CDs. In the 1990s, after the reserve requirement on CDs was set to zero, it is difficult to distinguish the Eurodollar CD rate from the U.S. CD rate. Indeed, during the 1990s and early 2000, the average rate paid on three-month Eurodollar CDs was 3.62 percent and on three-month U.S. CDs was 3.63 percent. The correlation on the movements in the two rates was 0.99988—that is, returns on three-month Eurodollar CDs and U.S. CDs were virtually identical in the 1990s and early 2000s.

Eurocommercial paper
Eurosecurities issued in Europe by dealers of commercial paper without involving a bank.

Eurocommercial Paper. **Eurocommercial paper** (Euro-CP) is issued in Europe by dealers of commercial paper without involving a bank. The Eurocommercial paper rate is

TABLE 5–9 Eurocommercial Paper Outstanding, 1995–2004
(in billions of U.S. dollars)

	Amount Outstanding			
	1995	1998	2001	2004
Eurocommercial paper	$87.0	$132.9	$243.1	$414.9
Currency type				
U.S. dollar	55.7	77.9	102.7	112.5
Euro-area currencies*	9.1	24.1	80.5	208.6
Japanese yen	2.1	3.5	13.6	4.2
Pound sterling	N/A	N/A	29.1	63.1
Other currencies	20.0	27.3	17.2	26.5
Issuer nationality				
Germany	14.4	28.3	108.6	142.4
United Kingdom	9.2	26.1	48.8	98.6
United States	19.5	22.0	50.9	78.1
Japan	18.0	6.6	11.6	16.8
Other developed countries	55.8	91.5	176.2	263.5
Other	15.6	26.6	13.0	13.4

*The BIS used the deutsche mark in 1995.

Source: Bank for International Settlements, "International Banking and Financial Market Developments," *Quarterly Review,* various issues. **www.bis.org**

generally about one-half to 1 percent above the LIBOR rate. Foreign commercial paper markets are new and small relative to U.S. commercial paper markets. Eurocommercial paper is issued in local currencies as well as in U.S. dollars. Table 5–9 lists the amount of Eurocommercial paper outstanding in the international money markets from 1995 through 2004 by currency and nationality of issuer. Notice that with the introduction of the European Currency Unit in 1999, Eurocommercial paper denominated in Euro area currencies increased significantly. By 2004, more than 50 percent of all Eurocommercial paper outstanding was denominated in euros. In comparison, U.K. (British pound sterling) issuances comprised 15 percent of all Eurocommercial paper issuances, while U.S dollar–denominated new issuances fell to 27 percent of the total. Projections are that with the full introduction of the euro in 2002 replacing the EC unit currencies, the euro money market will only continue to grow.

SUMMARY

In this chapter, we reviewed money markets, which are markets that trade debt securities with original maturities of one year or less. The need for money markets arises because cash receipts do not always coincide with cash expenditures for individuals, corporations, and government units. Because holding cash involves an opportunity cost, holders of excess cash invest these funds in money market securities. We looked at the various money market securities available to short-term investors and the major borrowers and issuers of each. We also outlined the processes by which each of these securities are issued and traded in secondary markets. We concluded the chapter by examining international issues involving money markets, taking a particular look at Euro money markets.

SEARCH THE SITE

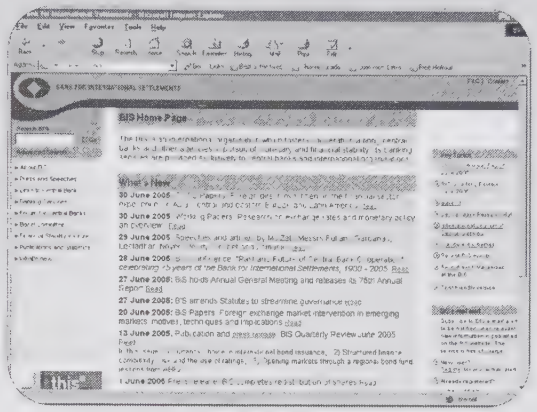
Go to the Bank for International Settlements Web site **at www.bis.org** and update the data for international Money Market Instruments Outstanding in Table 5–9 using the following steps.

Click on "BIS Quarterly Review"

Click on "Statistical Annex Read"

Click on "Securities Markets"

This will bring up a file to your computer that contains the relevant data: Table 13A Money Market Instruments.



Questions

1. What is the most recent value of money market instruments outstanding by currency type and issuer type?
2. How have these numbers changed since 2004 as reported in Table 5–9?

QUESTIONS

1. What are the three characteristics common to money market securities?
2. What is the difference between a discount yield and a bond equivalent yield? Which yield is used for Treasury bill quotes?
3. Why can discount yields not generally be compared to yields on other (nondiscount) securities?
4. What is the discount yield, bond equivalent yield, and effective annual return on a $1 million Treasury bill that currently sells at 97 3/8 percent of its face value and is 65 days from maturity?
5. Calculate the bond equivalent yield and effective annual return yield on a jumbo CD that is 115 days from maturity and has a quoted nominal yield of 6.56 percent.
6. Describe the T-bill auction process.
7. What is the difference between a competitive bid and a noncompetitive bid in a T-bill auction?
8. You would like to purchase a Treasury bill that has a $10,000 face value and is 68 days from maturity. The current price of the Treasury bill is $9,875. Calculate the discount yield on this Treasury bill.
9. Suppose you purchase a T-bill that is 125 days from maturity for $9,765. The T-bill has a face value of $10,000.
   a. Calculate the T-bill's quoted discount yield.
   b. Calculate the T-bill's bond equivalent yield.
10. Refer to Table 5–5.
    a. Calculate the ask price of the T-bill maturing on January 6, 2005, as of November 10, 2004.
    b. Calculate the bid price of the T-bill maturing on March 17, 2005, as of November 10, 2004.
11. eXcel **Using a Spreadsheet to Calculate T-bill Prices:** What is the bid price of a $10,000 face value T-bill with a bid rate of 2.23 percent if there are 10, 25, 50, 100, and 250 days to maturity?

Face Value	Bid Rate	Days to Maturity	=>	The Answer Will Be
$10,000	2.23%	10		$9,993.81
10,000	2.23	25		9,984.51
10,000	2.23	50		9,969.03
10,000	2.23	100		9,938.06
10,000	2.23	250		9,845.14

12. A T-bill that is 225 days from maturity is selling for $95,850. The T-bill has a face value of $100,000.
    a. Calculate the discount yield and bond equivalent yield on the T-bill.
    b. Calculate the discount yield and bond equivalent yield on the T-bill if it matures in 300 days.
13. eXcel **Using a Spreadsheet to Calculate T-bill Yield:** What is the quoted yield of a $10,000 face value T-bill with a market price of $8,885 if there are 10, 25, 50, 100, and 250 days to maturity?

Face Value	Market Price	Days to Maturity	=>	The Answer Will Be
$10,000	$8,885	10		4.014%
10,000	8,885	25		1.606
10,000	8,885	50		0.803
10,000	8,885	100		0.401
10,000	8,885	250		0.161

14. What are federal funds? How are they recorded on the balance sheets of commercial banks?
15. Describe the two types of fed funds transactions.
16. If the overnight fed funds rate is quoted as 2.25 percent, what is the bond equivalent rate? Calculate the bond equivalent rate on fed funds if the quoted rate is 3.75 percent.
17. What is the difference between a repurchase agreement and a reverse repurchase agreement?
18. Suppose a bank enters a repurchase agreement in which it agrees to buy Treasury securities from a correspondent bank at a price of $24,950,000, with the promise to buy them back at a price of $25,000,000.
    a. Calculate the yield on the repo if it has a 7-day maturity.
    b. Calculate the yield on the repo if it has a 21-day maturity.
19. Why do commercial paper issues have an original maturity of 270 days or less?
20. Why do commercial paper issuers almost always obtain a rating of their issues?
21. You can buy commercial paper of a major U.S. corporation for $495,000. The paper has a face value of $500,000 and is 45 days from maturity. Calculate the discount yield and bond equivalent yield on the commercial paper.
22. What is the process through which negotiable CDs are issued?
23. You have just purchased a four-month, $500,000 negotiable CD, which will pay a 5.5 percent annual interest rate.
    a. If the market rate on the CD rises to 6 percent, what is its current market value?
    b. If the market rate on the CD falls to 5.25 percent, what is its current market value?
24. Describe the process by which a banker's acceptance is created.
25. Who are the major issuers of and investors in money market securities?
26. What are Eurodollar CDs and Eurocommercial paper?

APPENDIX 5A: Single versus Discriminating Price Treasury Auctions

View this appendix at
www.mhhe.com/sc3e

APPENDIX 5B: Creation of a Banker's Acceptance

View this appendix at
www.mhhe.com/sc3e

Chapter 5

Bond Markets

OUTLINE

Chapter NAVIGATOR

1. What are the major bond markets?
2. What are the characteristics of the various bond market securities?
3. Who are the major bond market participants?
4. What types of securities trade in international bond markets?

DEFINITION OF BOND MARKETS: CHAPTER OVERVIEW

Equity (stocks) and debt (notes, bonds, and mortgages) instruments with maturities of more than one year trade in **capital markets.** In the next several chapters, we look at characteristics of the different capital markets, starting in this chapter with bond markets.[1] In Chapter 7, we look at the mortgage markets (e.g., mortgage-backed securities, asset-backed securities), and in Chapter 9, we describe the equity markets.

Bonds are long-term debt obligations issued by corporations and government units. Proceeds from a bond issue are used to raise funds to support long-term operations of the issuer (e.g., for capital expenditure projects). In return for the investor's funds, bond issuers promise to pay a specified amount in the future on the maturity of the bond (the face value) plus coupon interest on the borrowed funds (the coupon rate times the face value of the bond). If the terms of the repayment are not met by the bond issuer, the bond holder (investor) has a claim on the assets of the bond issuer.

Bond markets are markets in which bonds are issued and traded. They are used to assist in the transfer of funds from individuals, corporations, and government units with excess funds to corporations and government units in need of long-term debt funding. Bond markets are traditionally classified into three types: (1) Treasury notes and bonds, (2) municipal bonds, and (3) corporate bonds. Figure 6–1 shows the distribution of each type

1. Although both notes and bonds are issued by agents such as the U.S. government, their characteristics (e.g., coupon rate) other than maturity are generally the same. In this chapter, the term *bond* will mean bonds and notes in general, except where we distinguish notes by their special maturity features. For example, U.S. Treasury notes have maturities of over one year up to 10 years. U.S. Treasury bonds have maturities from over 10 years to 30 years at the time of issue.

capital markets

Markets that trade debt (bonds and mortgages) and equity (stocks) instruments with maturities of more than one year.

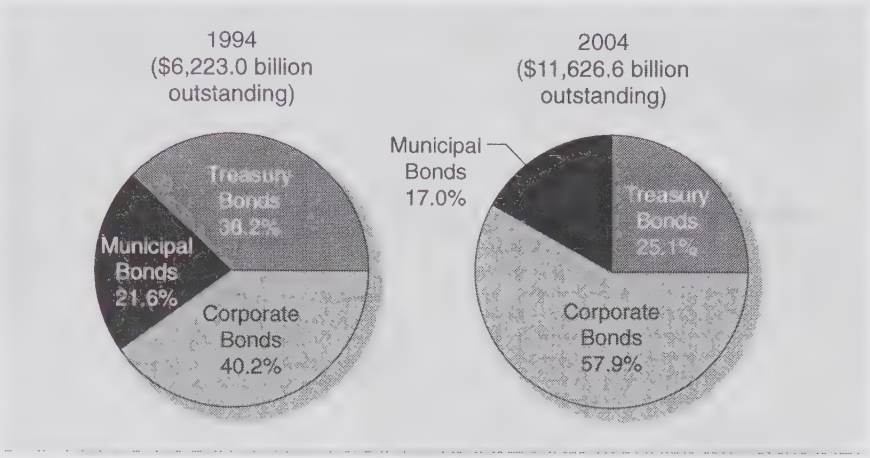
bonds

Long-term debt obligations issued by corporations and government units.

bond markets

Markets in which bonds are issued and traded.

FIGURE 6–1 Bond Market Instruments Outstanding, 1994–2004



Source: Federal Reserve Board Web site, "Flow of Funds Accounts," various issues. **www.federalreserve.gov**

outstanding in 1994 and 2004. In this chapter, we look at the characteristics of the various bond securities (including the trading process in bond markets), the participants in the bond markets, and international bond markets and securities.

2 BOND MARKET SECURITIES

Government units and corporations are the major bond security issuers. Figure 6–1 shows that the dollar amount of bond securities issued by these groups has increased 86.8 percent, from $6,223.0 billion in 1994 to $11,626.6 billion in 2004. In this section, we look at the bond market securities issued by each of these issuers: Treasury notes and bonds, municipal bonds, and corporate bonds.

Treasury Notes and Bonds

Treasury notes and bonds

Long-term bonds issued by the U.S. Treasury to finance the national debt and other federal government expenditures.

Treasury notes and bonds (T-notes and T-bonds) are issued by the U.S. Treasury to finance the national debt and other federal government expenditures ($2,920.8 billion outstanding in September 2004). The national debt (ND) reflects the historical accumulation of annual federal government deficits or expenditures (G) minus taxes (T) over the last 200-plus years, as follows:

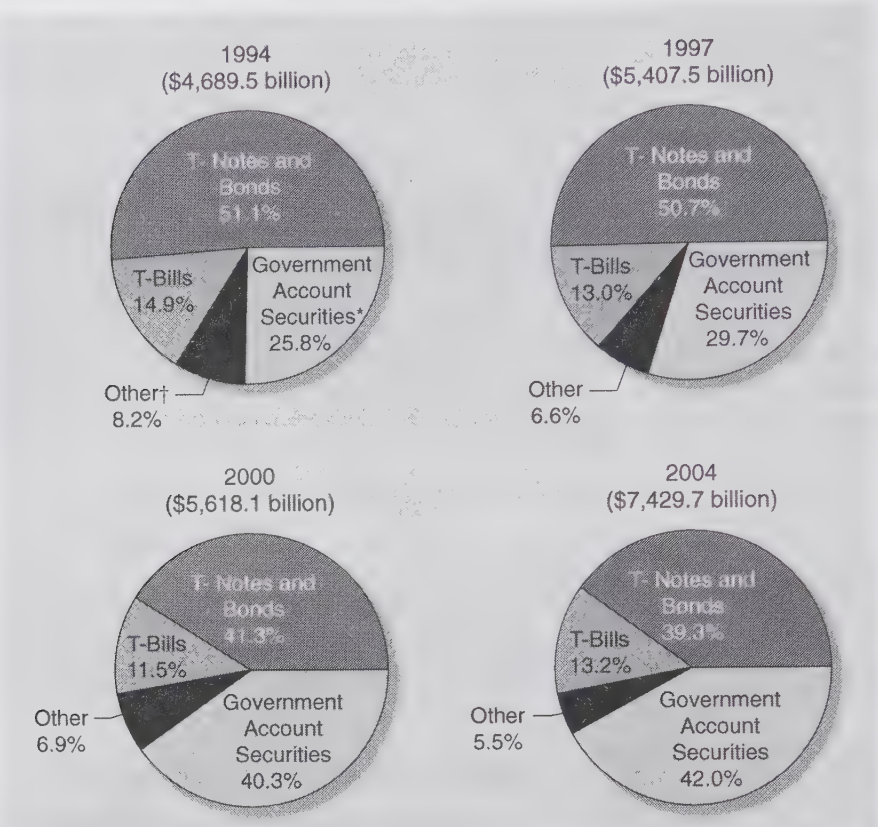
$$ND_t = \sum_{t=1}^{N} (G_t - T_t)$$

www.ustreas.gov

Figure 6–2 shows the composition of the U.S. national debt from 1994 through 2004. Notice that over this period, approximately 40 to 50 percent of the U.S. national debt consisted of Treasury notes and bonds.[2] Notice also that as the U.S. economy boomed in the late 1990s

2. Included as part of the U.S. national debt are government account securities. These include U.S. savings securities, dollar-denominated foreign government securities issued by the U.S. Treasury directly to foreign governments, federal insurance fund securities, federal retirement fund securities, and others.

FIGURE 6–2 Composition of the U.S. National Debt



*Includes securities held by government trust funds, revolving funds, and special funds such as Social Security and government pension funds.

†Includes U.S. savings securities, dollar-denominated foreign government securities issued by the U.S. Treasury directly to foreign governments, and other.

Source: U.S. Treasury Department, *Treasury Bulletin*, November 2004. **www.ustreas.gov**

and the U.S. budget deficit shrank, the amount of public debt outstanding in the form of U.S. Treasury securities decreased from a year-end high of $3.44 trillion in 1997 to $2.97 trillion in 2000. However, as the U.S. budget deficit grew in the early 2000s, so did the level of outstanding U.S. Treasury securities, to $3.9 trillion by 2004.

Like T-bills, T-notes and bonds are backed by the full faith and credit of the U.S. government and are, therefore, default risk free. As a result, T-notes and bonds pay relatively low rates of interest (yields to maturity) to investors. T-notes and bonds, however, are not completely risk free. Given their longer maturity (i.e., duration), these instruments experience wider price fluctuations than do money market instruments as interest rates change (and thus are subject to interest rate risk—see Chapter 22). Further, many of the older issued bonds and notes—"off the run" issues—may be less liquid than newly issued bonds and notes—"on the run" issues—in which case they may bear an additional premium for illiquidity risk. Figure 6–3 shows the pattern of 10-year T-note yields versus 3-month T-bill yields from 1980 through 2004.

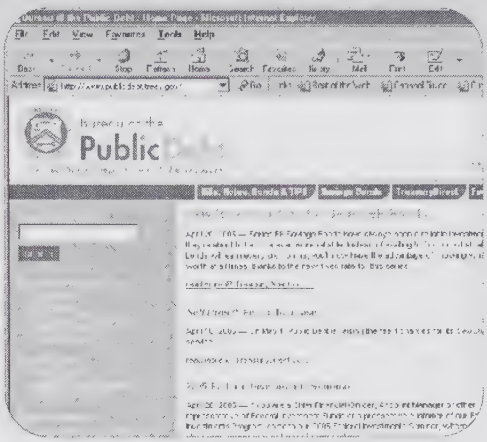
SEARCH THE SITE

Go to the Bureau of the Public Debt Web site at **www.publicdebt.treas.gov** and find the latest information available on the composition of the U.S. national debt using the following steps.

Click on "The Public Debt Online"

Under the section Monthly Statement of the Public Debt, click on "Summary page"

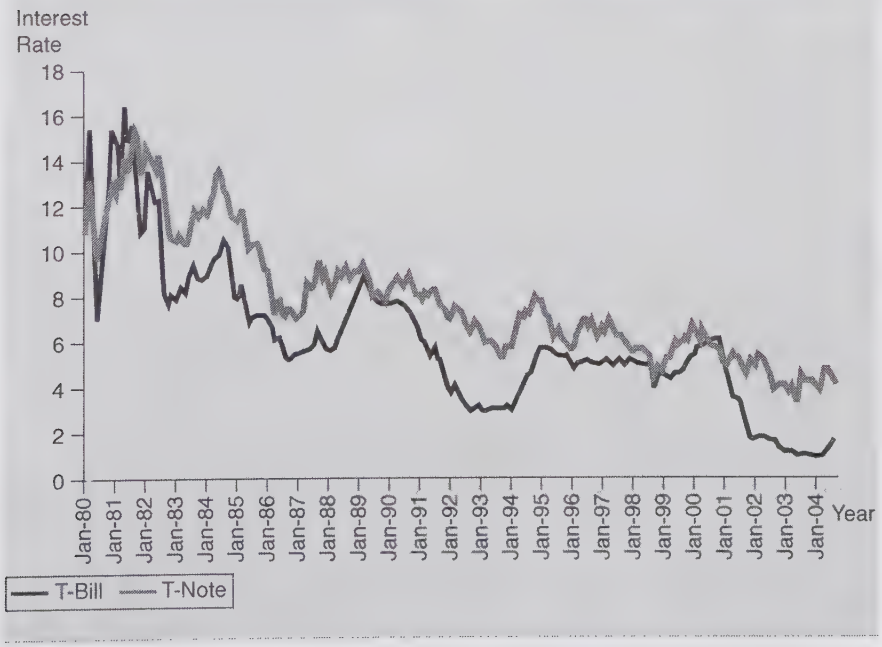
This will bring up the relevant tables.



Questions

1. How has this number changed since 2004 reported in Figure 6–2?
2. Calculate the percentage of the national debt comprised of T-notes and bonds, T-bills, government account securities, and other securities.

FIGURE 6–3 T-Bill versus T-Note Yields, 1980–2004



Source: Federal Reserve Board Web site, "Research and Data," November 2004. **www.federalreserve.gov**

In contrast to T-bills, which are sold on a discount basis from face value (see Chapter 5), T-notes and T-bonds pay coupon interest (semiannually). Further, T-bills have an original maturity of one year or less. Treasury notes have original maturities from over 1 to 10 years, while T-bonds have original maturities from over 10 years. T-notes and bonds are issued in minimum denominations of $1,000, or in multiples of $1,000. The Treasury issues two types of notes and bonds: fixed principal and inflation-indexed. While both types pay interest twice a year, the principal value used to determine the percentage interest payment (coupon) on inflation-indexed bonds is adjusted to reflect inflation (measured by the Consumer Price Index). Thus, the semiannual coupon payments and the final principal payment are based on the inflation-adjusted principal value of the security.[3]

Like T-bills, once issued T-notes and T-bonds trade in very active secondary markets. Table 6–1 presents part of a T-note and T-bond (including Treasury STRIPS—see below) closing price/interest yield quote sheet from *The Wall Street Journal* for trading on November 9, 2004. Column 1 in the table lists the coupon rate on the Treasury security. Note that coupon rates are set at intervals of 0.125 (or $\frac{1}{8}$ of 1) percent. Column 2 is the month and year the note or bond matures (an "n" after the year means that the security is a T-note—i.e., having an original maturity of 10 years or less). Column 3, labeled BID, is the close of the day selling price (in percentage terms) available to T-note and bond holders (i.e., the price dealers are willing to pay T-note and bond holders for their Treasury securities). Prices are quoted as percentages of the face value on the Treasury security, in 32nds. For example, using a face value of $1,000, the bid price on the 6.750 percent coupon, May 05 T-note was $1,022.1875 ($102\frac{7}{32}\% \times \$1{,}000$). Column 4, labeled ASKED, is the close of the day purchase price available to investors. Column 5, labeled CHG, is the change in the asked price from the previous day's close in 32nds—that is, the June 2009 T-note's price decreased by $\frac{1}{32}$ from the previous day. Finally, the last column, labeled ASK YLD, is the asked price converted into a rate of return (yield to maturity) on the T-note or T-bond. This yield is calculated using the yield to maturity formulas found in Chapter 3—it is the interest rate or yield (using semiannual compounding) that makes the price of the security just equal to the present value of the expected coupon and face value cash flows on the bond (where this yield is the single discount rate that makes this equality hold).

STRIP

A Treasury security in which the periodic interest payment is separated from the final principal payment.

STRIPS. In 1985, the Treasury began issuing 10-year notes and 30-year bonds[4] to financial institutions using a book-entry system under a program titled Separate Trading of Registered Interest and Principal Securities (STRIPS). A **STRIP** is a Treasury security in which periodic coupon interest payments can be separated from each other and from the final principal payment. As illustrated in Figure 6–4, a STRIP effectively creates two sets of securities—one set for each semiannual interest payment and one set for the final principal payment. Each of the components of the STRIP are often referred to as "Treasury zero bonds" or "Treasury zero-coupon bonds" because investors in the individual components only receive the single stripped payments (e.g., the third semiannual coupon) in which they invest. Investors needing a lump sum payment in the distant future (e.g., life insurers) would prefer to hold the principal portion of the STRIP. Investors wanting nearer-term cash flows (e.g., commercial banks) would prefer the interest portions of the STRIP. Also, some state lotteries invest the present value of large lottery prizes in STRIPS to be sure that funds are available to meet required annual payments to lottery winners. Pension funds purchase STRIPS to match payment cash flows received on their assets (STRIPS) with those required on their liabilities (pension contract payments).

STRIPs were created by the U.S. Treasury in response to the separate trading of Treasury security principal and interest that had been developed by securities firms. Specifically, in the

3. For example, a two-year, 10 percent coupon (annual) bond issued with a principal value (face value) of $1,000 will pay a total of $10 and $10 in the first and second years. An indexed (annual) bond when inflation is 10 percent in the first year and the second year will pay a 10 percent coupon based on principal values of $1,000 (1.1) = $1,100 and $1,000 $(1.1)^2$ = $1,210, respectively. That is, the first year coupon will be 10% × $1,100 = $11 and the second year coupon will be 10% × $1,210 = $12.10.

4. The U.S. Treasury stopped issuing 30-year bonds in 2001. However, the treasury reviewed the assurance of 30-year bonds in 2006.

TABLE 6–1 Treasury Note and Bond Quote

Treasury Bonds, Notes and Bills

November 9, 2004

Explanatory Notes

Representative Over-the-Counter quotation based on transactions of $1 million or more. Treasury bond, note and bill quotes are as of 4 p.m. Eastern time. Colons in bid-and-asked quotes represent 32nds; 101:01 means 101 1/32. Net changes in 32nds. n-Treasury note. i-Inflation-indexed issue. Treasury bill quotes in hundredths, quoted on terms of a rate of discount. Days to maturity calculated from settlement date. All yields are to maturity and based on the asked quote. Latest 13-week and 26-week bills are boldfaced. For bonds callable prior to maturity, yields are computed to the earliest call date for issues quoted above par and to the maturity date for issues below par. *When issued.

Source: eSpeed/Cantor Fitzgerald

U.S. Treasury strips as of 3 p.m. Eastern time, also based on transactions of $1 million or more. Colons in bid and asked quotes represent 32nds; 99:01 means 99 1/32. Net changes in 32nds. Yields calculated on the asked quotation. ci-stripped coupon interest. bp-Treasury bond, stripped principal. np-treasury note, stripped principal. For bonds callable prior to maturity, yields are computed to the earliest call date for issues quoted above par and to the maturity date for issues below par.

Source: Reuters, Telerate & Co. via Street Software Technology Inc.

Government Bonds & Notes

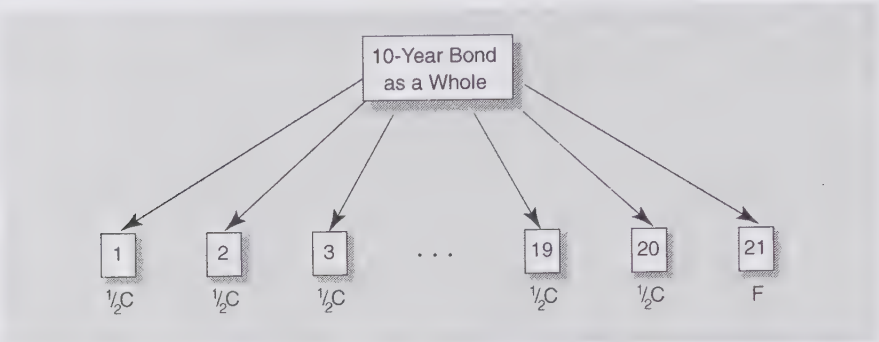
RATE	MATURITY MO/YR	BID	ASKED	CHG	ASK YLD
5.375	Nov 04n	100:01	100:02	-1	0.12
7.375	Nov 04n	100:02	100:03	-1	0.94
11.625	Nov 04	100:03	100:04	-1	1.21
2.000	Nov 04n	100:01	100:01	..	1.42
1.750	Dec 04n	100:00	100:00	1	1.76
1.625	Jan 05n	99:29	99:30	..	1.90
7.500	Feb 05n	101:14	101:15	..	1.87
1.500	Feb 05n	99:26	99:27	..	1.96
1.625	Mar 05n	99:25	99:26	..	2.11
1.625	Apr 05n	99:22	99:22	..	2.23
6.500	May 05n	102:04	102:05	..	2.25
6.750	May 05n	102:07	102:08	-1	2.29
12.000	May 05	104:30	104:31	+1	2.22
1.250	May 05n	99:14	99:15	1	2.22
1.125	Jun 05n	99:08	99:09	..	2.26
1.500	Jul 05n	99:13	99:14	1	2.29
6.500	Aug 05n	103:03	103:04	..	2.34
10.750	Aug 05	106:10	106:11	..	2.31
2.000	Aug 05n	99:21	99:22	..	2.37
1.625	Sep 05n	99:09	99:10	..	2.39
1.625	Oct 05n	99:06	99:07	..	2.44
5.250	Nov 05n	103:08	103:09	..	2.44
5.875	Nov 05n	103:12	103:13	+1	2.45
1.875	Nov 05n	99:11	99:12	..	2.46
1.875	Dec 05n	99:08	99:09	-1	2.50
2.000	Jan 06n	99:06	99:07	..	2.53
5.625	Feb 06n	103:26	103:27	..	2.51
9.375	Feb 06	108:14	108:15	-1	2.51
1.625	Feb 06n	98:25	98:26	..	2.56
1.500	Mar 06n	98:16	98:17	..	2.57
2.250	Apr 06n	99:14	99:15	..	2.62
2.000	May 06n	99:02	99:03	..	2.61
4.625	May 06n	102:29	102:30	+1	2.62
6.875	May 06n	106:08	106:09	-1	2.61
2.500	May 06n	99:23	99:24	..	2.65
2.750	Jun 06n	100:02	100:03	+1	2.68
7.000	Jul 06n	107:01	107:01	..	2.69
2.750	Jul 06n	100:01	100:02	..	2.71
2.375	Aug 06n	99:12	99:13	+1	2.71
2.375	Aug 06n	99:10	99:11	-1	2.74
2.500	Sep 06n	99:15	99:16	..	2.77
6.500	Oct 06n	106:30	106:31	..	2.76
2.500	Oct 06n	99:12	99:13	+1	2.80
2.625	Nov 06n	99:20	99:21	..	2.79
3.500	Nov 06n	101:10	101:11	-1	2.80
3.375	Jan 07f	100:24	100:25	+5	0.25
2.250	Feb 07n	98:20	98:21	+1	2.86
6.250	Feb 07n	107:11	107:12	-1	2.86
6.625	May 07n	108:28	108:29	..	2.92
4.375	May 07n	103:14	103:15	+1	2.93
3.125	May 07n	100:13	100:14	..	2.94
2.750	Aug 07n	99:10	99:11	1	3.00
3.250	Aug 07n	100:20	100:21	-1	2.99
6.125	Aug 07n	108:07	108:08	+1	2.99
3.000	Nov 07n	99:24	99:25	-2	3.07
3.625	Jan 08i	109:25	109:26	+4	0.51
3.000	Feb 08n	99:19	99:20	..	3.12
5.500	Feb 08n	107:09	107:10	-1	3.12
2.625	May 08n	98:04	98:05	..	3.18
5.625	May 08n	108:01	108:02	..	3.18
3.250	Aug 08n	100:00	100:01	1	3.24
3.125	Sep 08n	99:15	99:16	1	3.26
3.125	Oct 08n	99:12	99:13	1	3.29
3.375	Nov 08n	100:06	100:07	..	3.31
4.750	Nov 08n	105:12	105:13	..	3.30
3.375	Dec 08n	100:04	100:05	..	3.33
3.250	Jan 09n	99:18	99:19	..	3.35
3.875	Jan 09i	112:23	112:24	+5	0.77
3.000	Feb 09n	98:16	98:17	..	3.37
2.625	Mar 09n	96:28	96:29	-1	3.39
3.125	Apr 09n	98:27	98:28	..	3.40
3.875	May 09n	101:27	101:28	..	3.42
5.500	May 09n	108:26	108:27	..	3.37
4.000	Jun 09n	102:09	102:10	+1	3.45
3.625	Jul 09n	100:29	100:30	..	3.47
3.500	Aug 09n	100:02	100:03	..	3.48
6.000	Aug 09n	111:00	111:00	..	3.47
3.375	Sep 09n	99:14	99:15	..	3.49
3.375	Oct 09n	99:11	99:12	..	3.53
10.375	Nov 09	100:04	100:05	-1	0.02
4.250	Jan 10i	114:13	114:14	-5	0.92
6.500	Feb 10n	113:29	113:30	..	3.57
11.750	Feb 10	102:16	102:17	-1	2.04
0.875	Apr 10i	99:03	99:04	+3	1.04
10.000	May 10	103:30	103:31	..	2.16
5.750	Aug 10n	110:21	110:22	..	3.67
12.750	Nov 10	110:08	110:09	-1	2.40
3.500	Jan 11i	113:24	113:25	-4	1.18
5.000	Feb 11n	106:25	106:26	1	3.77
13.875	May 11	116:18	116:19	-3	2.61
5.000	Aug 11n	106:23	106:24	1	3.86
14.000	Nov 11	122:03	122:04	-3	2.64
3.375	Jan 12i	113:25	113:26	-5	1.35
4.875	Feb 12n	105:27	105:28	..	3.94
3.000	Jul 12i	111:07	111:08	-4	1.45
4.375	Aug 12n	102:13	102:14	..	4.01
4.000	Nov 12n	99:25	99:26	..	4.03

U.S. Treasury Strips

MATURITY	TYPE	BID	ASKED	CHG	ASK YLD
Nov 04	ci	100:00	100:00	..	1.86
Nov 04	bp	99:31	99:31	..	1.95
Nov 04	np	100:00	100:00	..	1.82
Jan 05	ci	99:23	99:23	..	1.63
Feb 05	ci	99:16	99:16	..	1.92
Feb 05	np	99:16	99:16	..	2.00
Apr 05	ci	99:05	99:05	..	2.03
May 05	ci	98:31	98:31	..	2.07
May 05	bp	98:27	98:27	..	2.30
May 05	np	98:27	98:27	..	2.30
May 05	np	98:27	98:27	..	2.30
Jul 05	ci	98:23	98:23	..	1.91
Aug 05	ci	98:11	98:11	..	2.20
Aug 05	bp	98:07	98:07	..	2.37
Aug 05	np	98:07	98:07	..	2.36
Oct 05	ci	97:28	97:28	..	2.34
Nov 05	ci	97:21	97:21	..	2.37
Nov 05	np	97:17	97:17	..	2.48
Nov 05	np	97:17	97:17	..	2.48
Jan 06	ci	97:16	97:16	..	2.16
Feb 06	ci	96:30	96:30	..	2.49
Feb 06	bp	96:28	96:28	..	2.53
Feb 06	np	96:25	96:29	..	2.51
Apr 06	ci	96:15	96:15	..	2.55
May 06	ci	96:06	96:06	..	2.59
May 06	np	96:04	96:04	..	2.63
May 06	np	96:05	96:05	..	2.61
Jul 06	ci	95:07	95:07	..	2.71
Jul 06	np	95:20	95:20	..	2.69
Aug 06	ci	95:16	95:16	..	2.64
Aug 06	np	95:11	95:11	..	2.72
Oct 06	np	94:26	94:26	..	2.79
Oct 06	ci	94:30	94:30	..	2.72
Nov 06	ci	94:21	94:21	..	2.75
Nov 06	np	94:17	94:17	..	2.82
Nov 06	np	94:17	94:17	..	2.81
Feb 07	ci	93:26	93:26	..	2.84
Feb 07	np	93:25	93:25	..	2.87
May 07	ci	92:30	92:30	..	2.94
May 07	np	92:30	92:30	..	2.94
May 07	np	92:30	92:30	..	2.94
Aug 07	ci	91:30	91:30	..	3.07
Aug 07	np	92:03	92:03	..	3.01
Aug 07	np	92:03	92:03	..	3.01
Nov 07	ci	91:07	91:07	..	3.08
Nov 07	np	91:08	91:08	..	3.07
Feb 08	ci	90:13	90:13	1	3.12
Feb 08	np	90:10	90:10	1	3.16
Feb 08	np	90:11	90:11	1	3.14
May 08	ci	89:14	89:14	1	3.20
May 08	np	89:15	89:15	1	3.20
Aug 08	ci	88:21	88:21	1	3.23
Aug 08	np	88:17	88:17	1	3.27
May 09	np	83:16	83:16	1	3.39
Nov 08	ci	87:17	87:17	1	3.35
Nov 08	np	87:18	87:18	1	3.34
Nov 08	np	87:18	87:18	1	3.34
Feb 09	ci	86:17	86:17	1	3.42
Feb 09	np	86:20	86:20	1	3.40
May 09	ci	85:20	85:20	1	3.47
May 09	np	85:27	85:27	1	3.41
May 09	np	85:21	85:21	1	3.46
Aug 09	ci	84:20	84:20	1	3.54
Aug 09	np	84:21	84:21	1	3.53
Nov 09	ci	83:29	83:29	1	3.54
Nov 09	bp	83:07	83:07	1	3.79
Feb 10	ci	82:21	82:21	2	3.65
Feb 10	np	82:20	82:20	-1	3.66
May 10	ci	81:23	81:23	2	3.70
Aug 10	ci	80:22	80:22	2	3.76
Aug 10	np	80:24	80:24	4	3.75
Nov 10	ci	80:02	80:02	2	3.73
Feb 11	ci	78:13	78:13	..	3.92
Feb 11	np	78:24	78:24	1	3.85
May 11	ci	77:14	77:14	..	3.97
Aug 11	ci	76:13	76:13	..	4.03
Aug 11	np	76:24	76:24	..	3.95
Nov 11	ci	75:17	75:17	..	4.05
Feb 12	ci	74:16	74:16	..	4.10
Feb 12	np	74:27	74:27	..	4.03
May 12	ci	73:15	73:15	..	4.15
Aug 12	ci	72:13	72:13	..	4.20
Aug 12	np	73:00	73:00	..	4.10
Nov 12	ci	71:14	71:14	..	4.24
Nov 12	np	72:06	72:06	..	4.11
Feb 13	ci	70:16	70:16	..	4.28
Feb 13	np	71:08	71:08	..	4.15
May 13	ci	69:17	69:17	..	4.32
May 13	np	70:19	70:19	..	4.14
Aug 13	ci	68:19	68:19	..	4.35
Aug 13	np	69:11	69:11	..	4.22
Nov 13	ci	67:22	67:22	..	4.38
Nov 13	np	68:12	68:12	..	4.26
Feb 14	ci	66:22	66:22	..	4.42
Feb 14	np	67:20	67:20	..	4.27
May 14	ci	65:24	65:24	..	4.46
May 14	np	66:22	66:22	..	4.31
Aug 14	ci	64:26	64:26	..	4.49
Nov 14	ci	63:27	63:27	..	4.53

Source: *The Wall Street Journal*, Friday, November 10, 2004, p. C15. Reprinted by permission of *The Wall Street Journal*. © 2004 Dow Jones & Company, Inc. All Rights Reserved Worldwide. **www.wsj.com**

FIGURE 6–4 Creation of a Treasury STRIP



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early 1980s, Merrill Lynch introduced Treasury Investment Growth Receipts (TIGRs). Merrill Lynch purchased Treasury securities, stripped them into one security representing the principal component only and a separate security for each coupon payment, and put these individual securities up for resale. The Treasury's creation of the STRIP was meant to offer a competitive product to the market.

The U.S. Treasury does not issue STRIPs directly to investors. Rather, stripped Treasury notes and bonds may be purchased only through financial institutions and government securities brokers and dealers, who create the STRIP components after purchasing the original T-notes or T-bonds (whole) in Treasury auctions (see below). After the STRIP components have been created, by requesting that the Treasury separate each coupon and face value payment on each bond and recording them as separate securities in its book-entry computer system, they can be sold individually in the secondary markets.[5]

EXAMPLE 6–1 Creation of a STRIP

Suppose the Treasury issues a five-year T-note with a par value of $10,000 and an 8 percent coupon rate (paid semiannually, or $400 is paid to the holder every six months for the next five years) to Citigroup. Citigroup decides to convert the bond into a set of stripped securities by requesting the Treasury to separate the coupons and face value of the note into separate securities on its computer system (basically giving each coupon and face value a separate I.D. or CUSIP number). This means that Citigroup can then sell 11 different securities: 10 securities associated with each of the semiannual coupon payments of $400 and one that pays $10,000 (the face or principal value) in five years to outside investors. We show the value of each of these securities in Table 6–2, assuming the yield to maturity on each of the stripped securities is 7.90 percent, and is the same as the bond sold "whole."

Notice that the total present value of the 11 different securities involved with the STRIP is the same as that of the original T-note before it is stripped, $10,040.65. However, in general, the bank (Citigroup) will try to sell the 11 stripped securities for a greater total present value than the bond as a whole. The reason for this is that many investors desire particular maturity zero-coupon bonds to meet investment goals and needs. Such goals and needs (such as duration targets—see below) are often harder to achieve through buying whole T-notes or T-bonds. Consequently, investors are willing to pay a higher price and thus accept a yield lower than 7.90 percent on the stripped investments. As a result, the total price Citigroup would get from selling the 11 STRIPS would exceed $10,040.65.

5. Once a bond is stripped, if an investor purchases each coupon and face value component at a later time, he or she can ask the Treasury to reconstitute the original bond on its computer system. Thus, the Treasury STRIP program is highly flexible and STRIPS can be reconstituted as whole bonds.

TABLE 6-2 Present Value of STRIP Components of a 10-Year T-Note with an 8 Percent Coupon Rate and 7.90 Percent Yield to Maturity

Maturity (years)	Cash Flow (8% Interest)	Present Value of Cash Flow at 7.90 Percent
0.5	$ 400	$ 384.80
1.0	400	370.18
1.5	400	356.11
2.0	400	342.58
2.5	400	329.56
3.0	400	317.04
3.5	400	304.99
4.0	400	293.40
4.5	400	282.25
5.0	400	271.53
5.0	10,000	6,788.21
Total		$10,040.65

As mentioned above, STRIPs are attractive investments to investors desiring particular maturity zero-coupon bonds to meet investment goals and needs. For example, STRIPs are used as investment securities for individual retirement accounts, Keogh plans, and pension funds. Frequently, managers of these types of financial institutions face the problem of structuring their asset investments so they can pay a given cash amount to policyholders in some future period. The classic example of this is an insurance policy that pays the holder some lump sum when the holder reaches retirement age. The risk to the life insurance company manager is that interest rates on the funds generated from investing the holder's premiums could fall. Thus, the accumulated returns on the premiums invested might not meet the target or promised amount. In effect, the insurance company would be forced to draw down its reserves and net worth to meet its payout commitments. (See Chapter 15 for a discussion of this risk.) To immunize or protect itself against interest rate risk, the insurer can invest in Treasury zero-coupon bonds (or STRIPS).

EXAMPLE 6-2 Using a STRIP to Immunize against Interest Rate Risk

Suppose that it is 2007 and an insurer must make a guaranteed payment to an investor in five years, 2012. For simplicity, we assume that this target guaranteed payment is $1,469,000, a lump sum policy payout on retirement, equivalent to investing $1,000,000 at an annually compounded rate of 8 percent over five years.

To immunize or protect itself against interest rate risk, the insurer needs to determine which investments would produce a cash flow of exactly $1,469,000 in five years, regardless of what happens to interest rates in the immediate future. By investing in a five-year maturity (and duration) Treasury zero-coupon bond (or STRIP), the insurance company would produce a $1,469,000 cash flow in five years, no matter what happens to interest rates in the immediate future.

Given a $1,000 face value and an 8 percent yield and assuming annual compounding, the current price per five-year STRIP is $680.58 per bond:

$$P = 680.58 = \frac{1.000}{(1.08)^5}$$

If the insurer buys 1,469 of these bonds at a total cost of $1,000,000 in 2007, these investments would produce $1,469,000 on maturity in five years. The reason is that the duration of this bond portfolio exactly matches the target horizon for the insurer's future liability to its policyholders. Intuitively, since the STRIP pays no intervening cash flows or coupons, future changes in interest rates have no reinvestment income effect. Thus, the return would be unaffected by intervening interest rate changes.

Most T-note and T-bond issues are eligible for the STRIP program. The components of a STRIP are sold with minimum face values of $1,000 and in increasing multiples of $1,000 (e.g., $2,000, $3,000). Thus, the par amount of the securities must be an amount that will produce semiannual coupon payments of $1,000 or a multiple of $1,000. The original Treasury note and bond issues that are eligible for the STRIP program are usually limited to those with large par values.

The T-note and bond quote list in Table 6–1 includes a portion of the Treasury STRIPS that traded on November 9, 2004. Look at the two rows for STRIPS maturing in August 2006. The first column of the quote lists the month and year the STRIP matures (e.g., Aug 06). The second column, labeled TYPE, indicates whether the instrument represents the coupon payments (ci) or the note's principal value (np) from the original Treasury note. Columns 3 and 4 list the bid and asked prices for the STRIPS. Like the quote for other Treasury securities (discussed above), the BID is the close of the day selling price (in percentage terms) available to STRIP holders (i.e., the price dealers are willing to pay T-note and bond holders for their Treasury securities). Prices are quoted as percentages of the face value on the Treasury security, in 32nds. The ASKED price is the close of the day purchase price available to investors. Column 5, labeled CHG, is the change in the asked price from the previous day's close in 32nds. Finally, the last column, labeled ASK YLD, is the asked price converted into a rate of return (yield to maturity) on the STRIP. This yield is calculated using the yield to maturity formulas found in Chapter 3, that is, it is the interest rate or yield (using semiannual compounding to correspond with the semiannual coupon payments that are "stripped" from each other and the final principal payment) that makes the price of the security just equal to the present value of the expected coupon or face value cash flows on the STRIP.

EXAMPLE 6–3 Calculation of Yield on a STRIP

For the principal (np) STRIP maturing in August 2006 (reported in Table 6–1), the ASKED price at the close on Tuesday, November 9, 2004 (or present value) is 95:11 (= $95^{11}/_{32}$, or 95.34375 percent). Settlement occurs two business days after purchase, so you receive actual ownership on Thursday, November 11, 2004. When the STRIP matures, on August 15, 2006 (in 1.764384 years), the STRIP holder will receive 100 percent of the face value (or future value). Using semiannual compounding, the yield to maturity (ytm), or ASK YLD is calculated as:

$$95^{11}/_{32}\% = 100\%(1 + ytm/2)^{2 \times 1.764384}$$

Solving for *ytm*, we get:

$$ytm = 2.72\%$$

Treasury Note and Bond Yields. Treasury note and bond yield to maturities and prices are calculated using bond valuation formulas presented in Chapter 3. The general bond valuation formula is:

$$V_b = \frac{INT}{m}(PVIFA_{i_d/m,Nm}) + M(PVIF_{I_d/m,Nm})$$

where

V_b = Present value of the bond
M = Par or face value of the bond
INT = Annual interest (or coupon) payment on the bond, equals the par value times the coupon rate
N = Number of years until the bond matures
m = Number of times per year interest is paid
i_d = Interest rate used to discount cash flows on the bond

EXAMPLE 6–4 Calculation of a T-Note Price from a *Wall Street Journal* Quote

From Table 6–1, there were two T-notes outstanding on November 9, 2004 (with a settlement date of November 11, 2004), with a maturity on July 15, 2006 (i.e., they were 1.67945 years from maturity). The first T-note had a coupon rate of 7.000 percent and an ASK YLD of 2.69 percent (*The Wall Street Journal* lists yields and prices to $^1/_{100}$ of 1 percent). Using the bond valuation formula, the ASKED price on the bond should have been:

$$V_b = \frac{7.000\%}{2}(PVIFA_{2.69\%/2,1.67945(2)}) + 100(PVIF_{2.69\%/2,1.67945(2)})$$

$$= 107.0312$$

or to the nearest $^1/_{32}$, $107^1/_{32}$. The ASKED quote reported in *The Wall Street Journal* was indeed $107^1/_{32}$.

For the second July 2006 maturity T-note, the coupon rate was 2.750 percent and the yield was 2.71 percent. The ASKED price on the bond should have been (and was):

$$V_b = \frac{2.750\%}{2}(PVIFA_{2.71\%/2,1.67945(2)}) + 100(PVIF_{2.71\%/2,1.67945(2)})$$

$$= 100.0652$$

or to the nearest $^1/_{32}$, $100^2/_{32}$.

accrued interest

That portion of the coupon payment accrued between the last coupon payment and the settlement day.

Accrued Interest. When an investor buys a T-note or T-bond between coupon payments, the buyer must compensate the seller for that portion of the coupon payment accrued between the last coupon payment and the settlement day (normally, settlement takes place 1 to 2 days after a trade). This amount is called **accrued interest.** Thus, at settlement, the buyer must pay the seller the purchase price of the T-note or T-bond plus accrued interest. The sum of these two is often called the *full price* or *dirty price* of the security. The price without the accrued interest added on is called the *clean price*.

Accrued interest on a T-note or T-bond is based on the actual number of days the bond was held by the seller since the last coupon payment:

$$\text{Accrued interest} = \frac{INT}{2} \times \frac{\text{Actual number of days since last coupon payment}}{\text{Actual number of days in coupon period}}$$

EXAMPLE 6–5 Calculation of Accrued Interest and Yield to Maturity on a Bond

On August 2, 2007, you purchase a $10,000 T-note that matures on May 15, 2013 (settlement occurs two days after purchase, so you receive actual ownership of the bond on August 4, 2007). The coupon rate on the T-note is 5.875 percent and the current price quoted on the bond is 101-11 (or 101.34375 percent of the face value of the T-note). The last coupon payment occurred on May 15, 2007 (81 days before settlement), and the next coupon payment will be paid on November 15, 2007 (103 days from settlement). We illustrate this time line in Figure 6–5.

The accrued interest due to the seller from the buyer at settlement is calculated as:

$$(5.875\%/2) \times 81/184 = 1.29314\%$$

of the face value of the bond, or $129.3134. The dirty price of this transaction is:

$$\text{Clean price} + \text{Accrued interest} = \text{Dirty price}$$
$$101.34375\% + 1.29314\% = 102.63689\%$$

of the face value of the bond, or $10,263.689 per $10,000 face value bond.

The yield to maturity (which is based on the clean price) on the bond received on August 4, 2007, and maturing on May 15, 2013 (a total of 5 years and 285 days, or 5.7808 years) is:

$$101.34375\% = \frac{5.875\%}{2}(PVIFA_{ytm/2,\,5.7808(2)}) + 100(PVIF_{ytm/2,\,5.7808(2)})$$

Solving for the yield to maturity, we get 5.632 percent.

Notice that as the purchase date approaches the coupon interest payment date, the accrued interest due to the seller from the buyer increases. Just before a coupon payment date the buyer pays the seller fractionally less than the full coupon payment. However, as the accrued interest portion of the dirty price of the note increases, the clean price of the note decreases to offset this, keeping the overall price of the note to the buyer constant. This is illustrated in Figure 6–6.

Treasury Inflation Protection Securities (TIPS). In January 1997, the U.S. Treasury began issuing inflation-indexed bonds called Treasury Inflation Protection Securities (TIPS), which provide returns tied to the inflation rate. Like the fixed-coupon bonds issued by the Treasury, the coupon rate on TIPS is determined by the auction process described below. However, unlike the fixed-principal bonds, the principal value of a TIPS bond can increase (or decrease) by the amount of U.S. inflation (or deflation) as measured by the percentage change in the Consumer Price Index (CPI) every six months. This principal is

FIGURE 6–5 Timeline Used to Determine Accrued Interest on a Bond

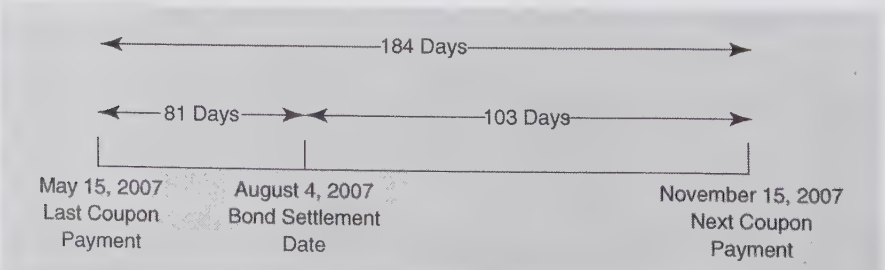
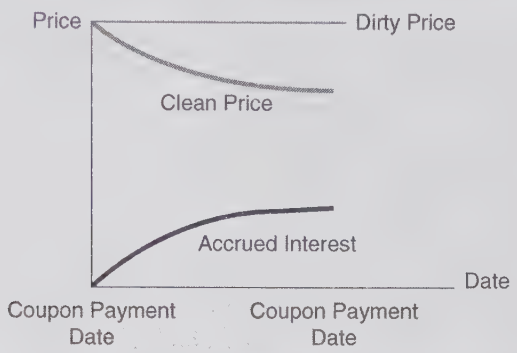


FIGURE 6–6 Dirty Price of Treasury Note



called the inflation-adjusted principal. TIPS bonds are used by investors who wish to earn a rate of return on their investments that keeps up with the inflation rate over time.

To see how TIPS bonds work, consider an investor who, on January 1, 2007, purchases a TIPS bond with an original principal of $100,000, a 4 percent annual (or 2 percent semiannual) coupon rate, and 10 years to maturity. The inflation-adjusted principal at the end of the first six months, on June 30, 2007, is found by multiplying the original par value ($100,000) by the semiannual inflation rate. Thus, if the semiannual inflation rate during the first six months is 0.5 percent, the principal amount used to determine the first coupon payment is adjusted upward by 0.5 percent ($100,000 × 1.005), to $100,500. Therefore, the first coupon payment, paid on June 30, 2007, is $2,010 ($100,500 × 2.0%). The inflation-adjusted principal at the beginning of the second six months is $100,500. Suppose that the semiannual inflation rate for the second six-month period is 1 percent. Then the inflation-adjusted principal at the end of the second six months (on December 31, 2007), and the principal amount used to determine the second coupon payment, is adjusted upward by 1 percent ($100,500 × 1.01), to $101,505. The coupon payment to the investor for the second six-month period is the inflation-adjusted principal on this coupon payment date ($101,505) times the semiannual coupon rate (2 percent). Thus, on December 31, 2007, the investor receives a coupon payment of $2,030.10 ($101,505 × 2.0%).

Primary and Secondary Market Trading in Treasury Notes and Bonds. As in primary market T-bill sales, the U.S. Treasury sells T-notes and T-bonds through competitive and noncompetitive Treasury auctions (see Chapter 5). Table 6–3 shows a recent auction pattern for T-note and T-bond new issues. The Treasury issues a press release about a week before each auction announcing the details of the auction, including the auction date, the amount to be sold, and other details about the securities to be issued (see In the News box).

TABLE 6–3 Auction Pattern for Treasury Notes and Bonds

Security	Purchase Minimum	General Auction Schedule
2-year note	$1,000	Monthly
3-year note	$1,000	February, May, August, November
5-year note	$1,000	February, May, August, November
10-year note	$1,000	February, May, August, November
30-year bond	$1,000	February, August

Source: U.S. Treasury Web site, Bureau of Public Debt, November 2004. **www.ustreas.gov**

IN THE NEWS

Treasury to Auction $24,000 Million of Two-Year Notes

The Treasury will auction $24,000 million of two-year notes to refund $26,880 million of publicly held notes maturing October 31, 2004, and to raise new cash of approximately $2,880 million. In addition to the public holdings, Federal Reserve Banks hold $5,560 million of the maturing notes for their own accounts, which may be refunded by issuing an additional amount of the new security.

Up to $1,000 million in noncompetitive bids from Foreign and International Monetary Authority (FIMA) accounts bidding through the Federal Reserve Bank of New York will be included within the offering amount of the auction. These noncompetitive bids will have a limit of $100 million per account and will be accepted in the order of smallest to largest, up to the aggregate award limit of $1,000 million.

Treasury Direct customers requested that we reinvest their maturing holdings of approximately $483 million into the two-year note.

The auction will be conducted in the single-price auction format. All competitive and noncompetitive awards will be at the highest yield of accepted competitive tenders. The allocation percentage applied to bids awarded at the highest yield will be rounded up to the next hundredth of a whole percentage point, e.g., 17.13 percent.

The notes being offered today are eligible for the STRIPS program.

This offering of Treasury securities is governed by the terms and conditions set forth in the Uniform Offering Circular for the Sale and Issue of Marketable Book-Entry Treasury Bills, Notes, and Bonds (31 CFR Part 356, as amended).

Details about the new security are given in the attached offering highlights.

Attachment

HIGHLIGHTS OF TREASURY OFFERINGS TO THE PUBLIC OF TWO-YEAR NOTES TO BE ISSUED NOVEMBER 1, 2004

October 25, 2004

Offering Amount	$24,000 million
Maximum Award (35% of Offering Amount)	$8,400 million
Maximum Recognized Bid at a Single Yield	$8,400 million
NLP Reporting Threshold	$8,400 million
Description of Offering:	
Term and type of security	2-year notes
Series	U-2006
CUSIP number	912828 CY 6
Auction date	October 27, 2004
Issue date	November 1, 2004
Dated date	October 31, 2004
Maturity date	October 31, 2006
Interest date	Determined based on the highest accepted competitive bid
Yield	Determined at auction
Interest payment dates	April 30 and October 31
Minimum bid amount and multiples	$1,000
Accrued interest payable by investor	Determined at auction
Premium or discount	Determined at auction

IN THE NEWS (Continued)

STRIPS Information:

Minimum amount required	$1,000
Corpus CUSIP number	912820 KW 6
Due date(s) and CUSIP number(s) for additional TINT(s)	October 31, 2006 – 912833 3N 8

Submission of bids:

Noncompetitive bids:

Accepted in full up to $5 million at the highest accepted yield.

Foreign and International Monetary Authority (FIMA) bids: Noncompetitive bids submitted through the Federal Reserve banks as agents for FIMA accounts. Accepted in order of size from smallest to largest with no more than $100 million awarded per account. The total noncompetitive amount awarded to Federal Reserve Banks as agents for FIMA accounts will not exceed $1,000 million. A single bid that would cause the limit to be exceeded will be partially accepted in the amount that brings the aggregate award total to the $1,000 million limit. However, if there are two or more bids of equal amounts that would cause the limit to be exceeded, each will be prorated to avoid exceeding the limit.

Competitive bids:

(1) Must be expressed as a yield with three decimals, e.g., 7.123%.

(2) Net long position for each bidder must be reported when the sum of the total bid amount, at all yields, and the net long position is $2 billion or greater.

(3) Net long position must be determined as of one-half hour prior to the closing time for receipt of competitive tenders.

Receipt of Tenders:

Noncompetitive tenders: Prior to 12:00 noon Eastern Daylight Saving time on auction day.

Competitive tenders: Prior to 1:00 p.m. Eastern Daylight Saving time on auction day.

Payment Terms: By charge to a funds account at Federal Reserve Bank on issue date, or payment of full par amount with tender. *Treasury Direct* customers can use the Pay Direct feature which authorizes a charge to their account of record at their financial institution on issue date.

Source: U.S. Treasury Web site, Bureau of Public Debt, November 19, 2004. **www.ustreas.gov**

www.federalreserve.gov

Bids may be submitted by government securities dealers, businesses, and individuals through a Federal Reserve Bank until noon Eastern time for noncompetitive bids and 1 P.M. Eastern time for competitive bids on the day of the auction. Awards are announced the following day. Table 6–4 shows the results of the two-year T-note auction of October 27, 2004. At this auction, 56.90 percent (or $29,559.73 million) of the submitted bids ($51,949.97 million) were accepted. Further, 4.11 percent ($742.34 million) of the accepted bids at the October 27, 2004 Treasury auction were noncompetitive. The auction is a single-bid auction—all bidders pay the same price, which is the price equal to the lowest price of the competitive bids accepted.[6]

6. Similar to Treasury bill auctions (discussed in Chapter 5), this single-price auction process went into effect in 1998. Prior to this the Treasury used a discriminatory auction process. Appendix 5A (located at the book's Web site **www.mhhe.com/sc3e**) compares the two types of auction.

TABLE 6–4 Announcement of Treasury Auction Results, October 27, 2004

PUBLIC DEBT NEWS

Department of the Treasury • Bureau of the Public Debt • Washington, DC 20239

TREASURY SECURITY AUCTION RESULTS
BUREAU OF THE PUBLIC DEBT - WASHINGTON DC

FOR IMMEDIATE RELEASE
October 27, 2004

CONTACT: Office of Financing
202-504-3550

RESULTS OF TREASURY'S AUCTION OF 2-YEAR NOTES

Interest Rate:	2 1/2%	Issue Date:	November 01, 2004
Series:	U-2006	Dated Date:	October 31, 2004
CUSIP No:	912828CY4	Maturity Date:	October 31, 2006

High Yield: 2.590% Price: 99.825825

All noncompetitive and successful competitive bidders were awarded securities at the high yield. Tenders at the high yield were allotted 37.24%. All tenders at lower yields were accepted in full.

Accrued interest of $ 0.06906 per $1,000 must be paid for the period from October 31, 2004 to November 01, 2004.

AMOUNTS TENDERED AND ACCEPTED (in thousands)

Tender Type	Tendered	Accepted
Competitive	$ 45,648,000	$ 23,257,762
Noncompetitive	742,337	742,337
FIMA (noncompetitive)	0	0
SUBTOTAL	46,390,337	24,000,099 1/
Federal Reserve	5,559,633	5,559,633
TOTAL	$ 51,949,970	$ 29,559,732

Median yield 2.560%: 50% of the amount of accepted competitive tenders was tendered at or below that rate. Low yield 2.450%: 5% of the amount of accepted competitive tenders was tendered at or below that rate.

Bid-to-Cover Ratio = 46,390,337 / 24,000,099 = 1.93

1/ Awards to TREASURY DIRECT = $583,001,000

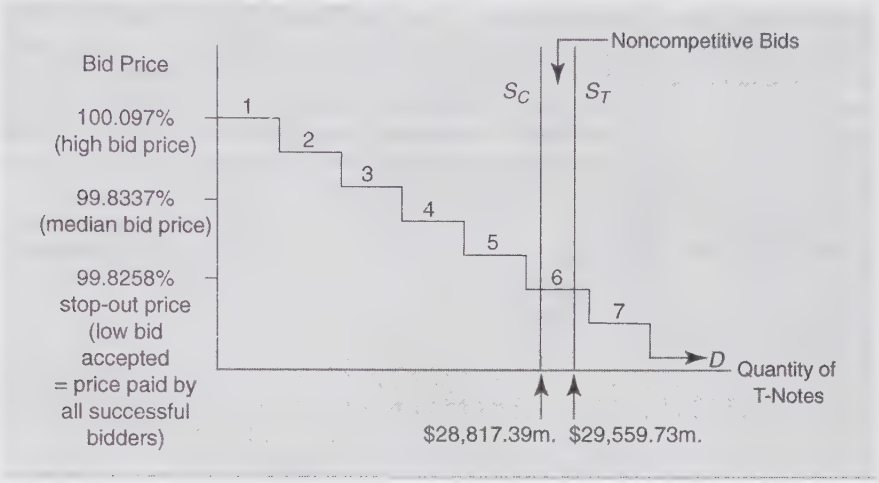
Source: U.S. Treasury Web site, Bureau of Public Debt, November 20, 2004. **www.ustreas.gov**

DO YOU UNDERSTAND?

Figure 6–7 illustrates the auction results for the two-year T-notes. The highest price offered on the two-year T-notes was 100.097 percent (or a yield of 2.45 percent) of the face value of the T-notes. Bids were filled at prices below the high. The lowest accepted bid price was 99.8258 percent (or a yield of 2.59 percent). At this price, all $29,559.73 million in two-year T-notes offered were sold. All bidders who submitted prices above 99.8258 percent (categories 1 through 5 in Figure 6–7) were awarded in full (winning bids) at the low price accepted (i.e., 99.8258 percent). Bidders who submitted a price below 99.8258 percent (categories 7 and beyond in Figure 6–7) received no allocation of the auctioned T-notes. A portion, but not all, of the bids submitted at 99.8258 were filled (category 6 in Figure 6–7). These bids are filled pro rata at this price. For example, if total bids in category 6 were $100 million, but only $25 million in notes remained to be allocated to competitive bidders (given the S_C supply curve in Figure 6–7), each bidder would receive 25 percent (1/4) of his or her bid quantity at this price. All of the $742.34 million noncompetitive bids were accepted at a price of 99.8258 percent (which is equal to the low price paid by the winning competitive bidders).

Most secondary market trading of Treasury notes and bonds occurs directly through broker and dealer trades (see Chapters 5 and 16). For example, according to the Federal Reserve

FIGURE 6–7 Treasury Auction Results



Bank of New York, the average daily trading volume in T-note and T-bond issues for the week ended November 12, 2004 was $552.67 billion. The Treasury quotes in Table 6–1 show just a small number of the Treasury securities that traded on November 9, 2004. The full quote listed in *The Wall Street Journal* shows the hundreds of different Treasury securities that trade daily.

Municipal Bonds

municipal bonds
Securities issued by state and local (e.g., county, city, school) governments.

Municipal bonds are securities issued by state and local (e.g., counties, cities, schools) governments ($1,977.2 billion outstanding in 2004) either to fund temporary imbalances between operating expenditures and receipts or to finance long-term capital outlays for activities such as school construction, public utility construction, or transportation systems. Tax receipts or revenues generated from a project are the source of repayment on municipal bonds.

Municipal bonds are attractive to household investors since interest payments on municipal bonds (but not capital gains) are exempt from federal income taxes and most state and local income taxes (in contrast, interest payments on Treasury securities are exempt only from state and local income taxes). As a result, the interest borrowing cost to the state or local government is lower, because investors are willing to accept lower interest rates on municipal bonds relative to comparable taxable bonds such as corporate bonds.

Municipal Bond Yields. To compare returns from tax-exempt municipal bonds with those on fully taxable corporate bonds, the after-tax (or equivalent tax-exempt) rate of return on a taxable bond can be calculated as follows:

$$i_a = i_b(1 - t)$$

where

i_a = After-tax (equivalent tax-exempt) rate of return on a taxable corporate bond
i_b = Before-tax rate of return on a taxable bond
t = Marginal income tax rate of the bond holder (i.e., the sum of his or her marginal federal, state, and local taxes)[7]

7. Treasury securities are exempt from federal taxes. Thus, the after-tax return on a Treasury security is calculated as:

$$i_a = i_b(1 - t_L)$$

where t_L = the sum of local and state tax rates.

EXAMPLE 6–6 Comparison of Municipal Bonds and Fully Taxable Corporate Bond Rates

Suppose you can invest in taxable corporate bonds that are paying a 10 percent annual interest rate or municipal bonds. If your marginal tax rate is 28 percent (i.e., the sum of federal, local, and state taxes on the last dollar of interest income), the after-tax or equivalent tax-exempt rate of return on the taxable bond is:

$$10\%(1 - .28) = 7.2\%$$

Thus, the comparable interest rate on municipal bonds of similar risk would be 7.2 percent.

Alternatively, the interest rate on a tax-exempt municipal bond can be used to determine the tax equivalent rate of return for a taxable security that would cause an investor to be just indifferent between the taxable and tax-exempt bonds of the same default and liquidity risks. Rearranging the equation above,

$$i_b = i_a/(1 - t)$$

EXAMPLE 6–7 Conversion of a Municipal Bond Rate to a Tax Equivalent Rate

You are considering an investment in a municipal bond that is paying $i_a = 6.5$ percent annually. If your marginal tax rate (t) is 21 percent, the tax equivalent rate of interest on this bond (i_b) is:

$$8.223\% = 6.5\%/(1 - .21)$$

general obligation bonds
Bonds backed by the full faith and credit of the issuer.

Two types of municipal bonds exist: general obligation bonds and revenue bonds. Table 6–5 shows the amount of both issued in 1990 through 2004. **General obligation (GO) bonds** are backed by the full faith and credit of the issuer—that is, the state or local government promises to use all of its financial resources (e.g., its taxation powers) to repay the bond. GO bonds have neither specific assets pledged as collateral backing the bond nor a specific revenue stream identified as a source of repayment of the bond's principal and interest. Because the taxing authority of the government issuer is promised to ensure repayment, the issuance of new GO bonds generally requires local taxpayer approval. Possibly because of this requirement, and taxpayers' reluctance to have their taxes increased, general obligation bonds represent a small portion of municipal bonds issued (38 percent in 2004).

TABLE 6–5 General Obligation and Revenue Bonds Issued, 1990 through 2004
(in billions of dollars)

	1990	2001	2004
General obligation bonds	$39,610	$100,519	$129,447
Revenue bonds	81,295	170,047	207,960

Source: Federal Reserve Bulletin, Table 1.45, May 1992, May 2002, and May 2004. **www.federalreserve.gov**

revenue bonds

Bonds sold to finance a specific revenue-generating project, backed by cash flows from that project.

Revenue bonds are sold to finance a specific revenue-generating project and are backed by cash flows from that project. For example, a revenue bond may be issued to finance an extension of a state highway. To help pay off the interest and principal on that bond, tolls collected from the use of the highway may be pledged as collateral. If the revenue from the project is insufficient to pay interest and retire the bonds on maturity as promised—perhaps because motorists are reluctant to use the highway and pay the tolls—general tax revenues may not be used to meet these payments. Instead, the revenue bond goes into default and bond holders are not paid. Thus, revenue bonds are generally riskier than GO bonds.

Municipal bonds are typically issued in minimum denominations of $5,000. Although trading in these bonds is less active than that of Treasury bonds, a secondary market exists for municipal bonds. Table 6–6 lists a municipal bond quote sheet from *The Wall Street Journal* on November 19, 2004. Column 1 lists the (local) government issuer. Column 2 lists the coupon rate (generally paid semiannually) on the bond issue. Column 3, labeled MAT, is the maturity date of the bond issue. Column 4, labeled PRICE, is the bond price in percentage terms (i.e., 101.503 = 101.503 percent of the face value). Column 5, labeled CHG, is the change in the price from the previous day's close. Column 6, labeled BID YLD, is the yield to maturity on the municipal bond based on the current selling price available to the municipal bond holder. As discussed above, these yields are not taxed at the federal, state, or local levels and are thus not comparable to corporate bond yields.

Municipal bonds are not default risk free. Defaults on municipal bonds peaked in 1990 at $1.4 billion, due mainly to a major economic recession in the United States. Unlike Treasury securities, for which the federal government (in the worst case) can raise taxes or print money to make promised payments, state and local governments are limited to their local tax and revenue base as sources of funds for municipal bond repayment.

The Trading Process for Municipal Bonds. The initial (primary market) sale for municipal bonds (and corporate bonds, discussed below) occurs either through a public offering, using an investment bank serving as a security underwriter, or through a private placement to a small group of investors (often financial institutions). Generally, when a large state or local governmental unit issues municipals to the public, many investment banks are interested in

TABLE 6–6 Municipal Bond Quote

Tax-Exempt Bonds

Representative prices for several active tax-exempt revenue and refunding bonds, based on institutional trades, but may not reflect actual transactions. Yield is to maturity. n-new.
Source: The Bond Buyer/Standard & Poor's Securities Evaluations. All rights reserved.

ISSUE	COUPON	MAT	PRICE	CHG	BID YLD	ISSUE	COUPON	MAT	PRICE	CHG	BID YLD
Atlanta GA psgr fac chg	5.000	01-01-34	101.503	+.160	4.81	NJ Econ DevAuth motor veh	5.000	07-01-34	102.661	+.155	4.66
Atlanta GA wtr/wastewtr 04	5.000	11-01-43	100.778	+.157	4.90	NYC gen oblig bds Fiscal 05	5.000	11-01-34	101.123	+.157	4.86
Atlanta GA wtr/wastewtr 04	5.000	11-01-37	101.645	+.158	4.79	NYC Muni Wtr Fin Auth	5.000	06-15-39	101.203	+.153	4.84
Berkeley Co Sch SC	5.000	12-01-28	100.250	+.144	4.97	Orlando Orange Co Exprwy	5.000	07-01-35	102.172	+.142	4.69
Burlington KS poll Sr04	5.300	06-01-31	105.764	+.157	4.56	Penn St Pub Sch Bldg	5.000	06-01-33	101.947	+.141	4.72
CA Infr&EcoDevBayAr toll	5.000	07-01-36	102.243	+.142	4.68	Penn Turnpke Comm Rv	5.000	12-01-34	102.497	+.160	4.69
Chicago IL GO Sr 04A	5.000	01-01-34	101.458	+.148	4.80	Port Auth NY&NJ consol	5.125	05-01-34	102.092	+.175	4.89
ChicagoIL genarpt 3rdref	5.250	01-01-34	102.248	+.147	4.94	Puerto Rico ElecPwrAuth	5.125	07-01-29	102.907	+.142	4.71
Clark Co NV arpt syst rv	5.000	07-01-36	101.121	+.153	4.85	Puerto Rico Pub Bldgs	5.000	07-01-36	100.984	+.153	4.87
Clark Co NV ind dev rev bd	5.000	12-01-33	100.154	+.156	4.98	Puerto Rico Pub Bldgs	5.250	07-01-33	103.976	+.156	4.74
Dallas ISD Tex sch ref bd	5.000	08-15-31	102.003	+.156	4.74	Puerto Rico pub impr GO	5.000	07-01-34	101.098	+.153	4.86
DallasFtWorthTX JointRv0	5.000	11-01-32	100.083	+.205	4.99	Puerto Rico pub impr GO	5.000	07-01-29	101.367	+.153	4.82
Denver Sch Dist Colo	4.500	12-01-28	96.926	+.280	4.71	Sacramento Co Sanit Dist	5.000	12-01-35	102.538	+.161	4.68
Illinois Finance Auth hosp	5.500	08-15-43	103.327	+.154	5.07	Sales Tx Asset Rec Corp NY	5.000	10-15-32	102.669	+.159	4.66
Metro Washington Arpt DC	5.000	10-01-34	100.079	+.224	4.99	Sales Tx Asset Rec Corp NY	5.000	10-15-29	102.910	+.160	4.63
MetropolitanTransAthNY	5.000	11-15-31	102.046	+.133	4.69	SaltRiver Prj Agri Imprv	4.750	01-01-32	100.062	+.219	4.74
Miami-DadeCoFLAviationRv	5.000	10-01-37	101.528	+.156	4.81	SaltRiver Prj Agri Imprv	5.000	01-01-31	102.271	+.135	4.66
Miami-DadeCoFLAviationRv	4.750	10-01-36	95.205	+.454	5.05	TexasTpkeAuthRvBds	5.000	08-15-42	100.247	+.127	4.96
Montgomery Co OH Sr04	5.000	05-01-30	100.822	+.150	4.89	Univ of CA limited proj	4.800	05-15-34	98.941	+.308	4.87
NJ Econ DevAuth motor veh	5.000	07-01-29	103.076	+.156	4.60	Univ of CA limited proj	4.875	05-15-37	100.511	+.139	4.80

Source: The *Wall Street Journal*, November 19, 2004, p. B6. Reprinted by permission of *The Wall Street Journal*. © 2004 Dow Jones & Company, Inc. All Rights Reserved Worldwide. **www.wsj.com**

TABLE 6–7 Top Municipal Bond Underwriters'

Underwriter	Principal Amount (in millions of dollars)	Market Share	Number of Issues
UBS Financial Services	$35,811.6	13.5%	631
Citigroup	30,092.8	11.3	476
Lehman Brothers	22,021.1	8.3	170
Merrill Lynch	18,708.8	7.1	208
Goldman Sachs	18,081.6	6.8	132
J.P. Morgan Securities	17,685.0	6.7	324
Bear, Stearns	15,464.1	5.8	133
Morgan Stanley	14,695.8	5.5	179
RBC Dain Rauscher	11,157.6	4.2	533
Banc of America Securities	10,403.2	3.9	327
Industry totals	$265.5 billion		

'Through September 2004.

Source: Thomson Financial Securities Data, November 2004. **www.tfibcm.com**

underwriting the bonds and the municipals can generally be sold in a national market. Total dollar volume of these new issues was $265.5 billion in the first three quarters of 2004, down from $289 billion in the first three quarters of 2003. Table 6–7 lists the activity of the top 10 municipal bond underwriters in 2004.

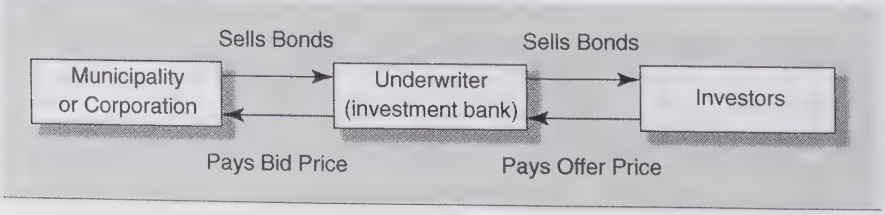
firm commitment underwriting

The issue of securities by an investment bank in which the investment bank guarantees the issuer a price for newly issued securities by buying the whole issue at a fixed price from the issuer. It then seeks to resell these securities to suppliers of funds (investors) at a higher price.

Firm Commitment Underwriting. Public offerings of municipal (and corporate, see below) bonds are most often made through an investment banking firm (see Chapter 16) serving as the underwriter. Normally, the investment bank facilitates this transfer using a **firm commitment underwriting,** illustrated in Figure 6–8. The investment bank guarantees the municipality (or corporation for a corporate bond) a price for newly issued bonds by buying the whole issue at a fixed price from the municipal issuer (the bid price). The investment bank then seeks to resell these securities to suppliers of funds (investors) at a higher price (the offer price). As a result, the investment bank takes a risk that it may not be able to resell the securities to investors at a higher price. This may occur if prices of municipal bonds suddenly fall due to an unexpected change in interest rates or negative information being released about the creditworthiness of the issuing municipality. If this occurs, the investment bank takes a loss on its underwriting of the security. However, the municipal issuer is protected by being able to sell the whole issue.

The investment bank can purchase the bonds through competitive bidding against other investment bankers or through direct negotiation with the issuer. In a competitive sale, the issuer invites bids from a number of underwriters. The investment bank that submits the highest bid to the issuer wins the bid. The underwriter may use a syndicate of other underwriters and investment banks to distribute (sell) the issue to the public. Most state and local governments require a competitive municipal bond issue to be announced in a trade publication, such as the *Bond Buyer*. With a negotiated sale, the investment bank obtains

FIGURE 6–8 Firm Commitment Underwriting of a Municipal or Corporate Bond Issue



the exclusive right to originate, underwrite, and distribute the new bonds through a one-on-one negotiation process. With a negotiated sale, the investment bank provides the origination and advising services to the issuers. Most states require that GO bonds be issued through competitive bids.

best-efforts offering

The issue of securities in which the investment bank does not guarantee a price to the issuer and acts more as a placing or distribution agent on a fee basis related to its success in placing the issue.

Best-Efforts Offering. Some municipal (and corporate) securities are offered on a **best-efforts** basis in which the investment bank does not guarantee a firm price to the issuer (as with a firm commitment offering) and acts more as a placing or distribution agent for a fee. With best-efforts offerings, the investment bank incurs no risk of mispricing the security since it seeks to sell the bonds at the price it can get in the market. In return the investment bank receives a fee. Further, the investment bank offers the securities at a price originally set by the municipality. Thus, the investment bank does not incur the expense of establishing the market price for the customer. Often, knowing that the investment bank has not put any of its own funds into the issue, investors in best-efforts issues are not willing to pay as much for the bonds as with a firm commitment issue.

private placement

A security issue placed with one or a few large institutional buyers.

Private Placement. In a **private placement,** a municipality (or corporation), sometimes with the help of an investment bank, seeks to find a large institutional buyer or group of buyers (usually fewer than 10) to purchase the whole issue. To protect smaller individual investors against a lack of disclosure, the Security and Exchange Act of 1934 requires publicly traded securities to be registered with the Securities and Exchange Commission (SEC). Private placements, on the other hand, can be unregistered and can be resold only to large, financially sophisticated investors (see below). These large investors supposedly possess the resources and expertise to analyze a security's risk.

Privately placed bonds (and stocks) have traditionally been among the most illiquid securities in the bond market, with only the very largest financial institutions or institutional investors being able or willing to buy and hold them in the absence of an active secondary market. In April 1990, however, the Securities and Exchange Commission amended its Regulation 144A. This allowed large investors to begin trading these privately placed securities among themselves even though, in general, privately placed securities do not satisfy the stringent disclosure and informational requirements that the SEC imposes on approved publicly registered issues. Rule 144A private placements may now be underwritten by investment banks on a firm commitment basis. Of the total $351.96 billion in private debt (municipal and corporate) placements in the first three quarters of 2004, $328.12 billion (93.2 percent) were Rule 144A placements. Credit Suisse First Boston was the lead underwriter of Rule 144A debt placements in 2004 (underwriting $48.82 billion, 14.9 percent of the total placements).

Issuers of privately placed bonds tend to be less well known (e.g., medium-sized municipalities and corporations). As a result of a lack of information on these issues, and the resulting possibility of greater risk, interest rates paid to holders of privately placed bonds tend to be higher than on publicly placed bond issues. Although Rule 144A has improved the liquidity of privately placed bonds, this market is still less liquid than the public placement market. Another result of the increased attention to this market by investment banks is that the interest premiums paid by borrowers of privately placed issues over public issues have decreased.

Although the SEC defined large investors as those with assets of $100 million or more—which excludes all but the very wealthiest household savers—it is reasonable to ask how long this size restriction will remain. As they become more sophisticated and the costs of information acquisition fall, savers will increasingly demand access to the private placement market. In such a world, savers would have a choice not only between the secondary securities from financial institutions and the primary securities publicly offered by municipalities and corporations but also between publicly offered (registered) securities and privately offered (unregistered) securities.

Secondary Market Trading. The secondary market for municipal bonds is thin (i.e., trades are relatively infrequent). Thin trading is mainly a result of a lack of information on bond

issuers, as well as special features (such as covenants) that are built into those bond's contracts. Information on municipal bond issuers (particularly of smaller government units) is generally more costly to obtain and evaluate, although this is in part offset by bond rating agencies (see below). In a similar fashion, bond rating agencies generate information about corporate and sovereign (country) borrowers as well.

Corporate Bonds

corporate bonds
Long-term bonds issued by corporations.

Corporate bonds are all long-term bonds issued by corporations ($6,728.6 billion outstanding in 2004, some 57.9 percent of all outstanding long-term bonds). The minimum denomination on publicly traded corporate bonds (which, in contrast to privately placed corporate bonds, require SEC registration) is $1,000, and coupon-paying corporate bonds generally pay interest semiannually.

bond indenture
The legal contract that specifies the rights and obligations of the bond issuer and the bond holders.

The **bond indenture** is the legal contract that specifies the rights and obligations of the bond issuer and the bond holders. The bond indenture contains a number of covenants associated with a bond issue. These bond covenants describe rules and restrictions placed on the bond issuer and bond holders. As described below, these covenants include such rights for the bond issuer as the ability to call the bond issue and restrictions as to limits on the ability of the issuer to increase dividends. By legally documenting the rights and obligations of all parties involved in a bond issue, the bond indenture helps lower the risk (and therefore the interest cost) of the bond issue. All matters pertaining to the bond issuer's performance regarding any debt covenants as well as bond repayments are overseen by a trustee (frequently a bank trust department) who is appointed as the bond holders' representative or "monitor." The signature of a trustee on the bond is a guarantee of the bond's authenticity. The trustee also acts as the transfer agent for the bonds when ownership changes as a result of secondary market sales and when interest payments are made from the bond issuer to the bond holder. The trustee also informs the bond holders if the firm is no longer meeting the terms of the indenture. In this case, the trustee initiates any legal action on behalf of the bond holders against the issuing firm. In the event of a subsequent reorganization or liquidation of the bond issuer, the trustee continues to act on behalf of the bond holders to protect their principal.

www.nyse.com

Table 6–8 presents a bond market quote sheet from *The Wall Street Journal* for November 9, 2004, for corporate bonds traded on the New York Stock Exchange (NYSE). Quotes are listed by dollar volume of trading, from highest to lowest. Look at the third quote posted in Table 6–8. Column 1 of the quote lists the issuer (Kraft Foods). Column 2 lists the coupon rate (4 percent). Column 3 lists the maturity date (October 1, 2008). Column 4, labeled LAST PRICE, is the closing price (in percent) of the bond on November 9 (100.292%). Column 5, labeled LAST YIELD, is the yield to maturity (see Chapter 3) on the bond (3.917%) using the LAST PRICE. Column 6, labeled *EST SPREAD, is the difference between the yield (in basis points) on the corporate bond and a similar maturity Treasury security (40 = .40%). Column 7, labeled UST†, lists the maturity (in years) of the Treasury security used to determine the spread (five-year note). Column 8, labeled EST $ VOL (000's), is the trading volume for the bond in thousands of dollars (130,423 = $130,423,000).

bearer bonds
Bonds with coupons attached to the bond. The holder presents the coupons to the issuer for payments of interest when they come due.

registered bond
A bond in which the owner is recorded by the issuer and the coupon payments are mailed to the registered owner.

Bond Characteristics. Corporate (and Treasury) bonds have many different characteristics that differentiate one issue from another. We list and briefly define these characteristics in Table 6–9, and we describe them in detail below.

Bearer versus Registered Bonds. Corporate bonds can be bearer bonds or registered bonds. With **bearer bonds,** coupons are attached to the bond and the holder (bearer) at the time of the coupon payment gets the relevant coupon paid on presentation to the issuer (i.e., gets the bond coupon "clipped"). With a **registered bond,** the bond holder's (or owner's) identification information is kept in an electronic record by the issuer and the coupon payments are mailed or wire-transferred to the bank account of the registered owner. Because of the

TABLE 6-8 Corporate Bond Market Quote

(1) (2) (3) (4) (5) (6) (7) (8)

Corporate Bonds

Tuesday, November 9, 2004

Forty most active fixed-coupon corporate bonds

COMPANY (TICKER)	COUPON	MATURITY	LAST PRICE	LAST YIELD	EST SPREAD	UST*	EST $ VOL (000's)
Goldman Sachs Group (GS)	6.600	Jan 15, 2012	111.904	4.628	42	10	183,115
Ford Motor Credit (F)	7.250	Oct 25, 2011	107.338	5.944	173	10	141,752
Kraft Foods (KFT)	4.000	Oct 01, 2008	100.292	3.917	40	5	130,423
General Motors (GM)	8.375	Jul 15, 2033	104.550	7.968	303	30	127,929
Ford Motor Co (F)	7.450	Jul 16, 2031	98.250	7.603	266	30	120,549
XL Capital Ltd (XL)	5.250	Sep 15, 2014	98.864	5.398	117	10	115,277
Time Warner (TWX)	6.875	May 01, 2012	112.842	4.806	58	10	114,582
Ford Motor Credit (F)	7.000	Oct 01, 2013	105.529	6.180	197	10	113,778
Morgan Stanley (MWD)	4.000	Jan 15, 2010	98.526	4.231	71	5	111,841
Kraft Foods (KFT)	5.625	Nov 01, 2011	105.874	4.628	42	10	109,405
General Electric (GE)	5.000	Feb 01, 2013	102.634	4.610	40	10	107,302
Time Warner (TWX)	7.700	May 01, 2032	113.498	6.278	134	30	99,994
Wells Fargo (WFC)	5.125	Sep 15, 2016	100.269	5.106	88	10	98,420
General Electric Capital (GE)	6.750	Mar 15, 2032	115.259	5.647	71	30	89,488
Morgan Stanley (MWD)	4.759	Apr 01, 2014	97.446	5.095	68	10	89,438
Sprint Capital (FON)	7.625	Jan 30, 2011	116.301	4.577	35	10	86,315
Goldman Sachs Group (GS)	4.750	Jul 15, 2013	98.847	4.914	71	10	83,936
General Motors Acceptance (GM)	8.000	Nov 01, 2031	103.417	7.697	277	30	80,007
Viacom (VIA)	5.625	Aug 15, 2012	106.356	4.638	41	10	77,880
BellSouth (BLS)	6.550	Jun 15, 2034	105.797	6.123	119	30	77,422
Viacom (VIA)	6.625	May 15, 2011	112.088	4.462	24	10	77,070
Merck (MRK)	2.500	Mar 30, 2007	97.693	3.520	44	3	76,900
General Motors Acceptance (GM)	6.875	Aug 28, 2012	107.988	6.380	217	10	76,677
Merck (MRK)	5.950	Dec 01, 2028	101.279	5.850	91	30	76,025
JP Morgan Chase (JPM)	5.250	May 30, 2007	104.464	3.401	32	3	75,487
General Motors Acceptance (GM)	7.250	Mar 02, 2011	105.425	6.194	198	10	72,393
CIT Group (CIT)	4.125	Nov 03, 2009	99.484	4.241	73	5	72,095
Ford Motor Credit (F)	5.625	Oct 01, 2008	102.594	4.881	136	5	70,022
COX Communications (COX)	4.625	Jun 01, 2013	94.082	5.502	128	10	69,084
Gillette (G)	3.800	Sep 15, 2009	99.980	3.803	30	5	68,635
Citigroup (C)	3.625	Feb 09, 2009	99.269	3.818	30	5	67,764
Comcast Cable Communications (CMCSA)	8.875	May 01, 2017	128.905	5.656	145	10	64,105
XL Capital Finance (Europe) PLC (XL)	6.500	Jan 15, 2012	109.260	4.908	73	10	62,910
Nordea Bank AB (NDASS)	5.250	Nov 30, 2012	103.632	4.702	50	10	62,600
General Motors Acceptance (GM)	5.350	Jan 14, 2009	102.023	5.300	178	5	60,762
Bank of America (BAC)	5.250	Dec 01, 2015	101.727	5.044	85	10	60,275
Liberty Media (L)	5.700	May 15, 2013	101.114	5.534	134	10	60,270
Comcast Holdings (CMCSA)	7.625	Feb 15, 2008	111.385	3.861	35	5	60,169
National Rural Utilities Cooperative Finance (NRUC)	7.250	Mar 01, 2012	115.264	4.748	53	10	57,618
General Motors Acceptance (GM)	6.875	Sep 15, 2011	103.399	6.220	206	10	55,410
AT&T Wireless Services (CING)	8.750	Mar 01, 2031	131.926	6.258	131	30	53,400

Volume represents total volume for each issue; price/yield data are for trades of $1 million and greater. *Estimated spreads, in basis points (100 basis points is one percentage point), over the 2, 3, 5, 10 or 30-year hot run Treasury note/bond. 2-year: 2.500 10/06; 3-year: 3.000 11/07; 5-year: 3.375 10/09; 10-year: 4.250 08/14; 30-year: 5.375 02/31. *Comparable U.S. Treasury issue.

Source: MarketAxess Corporate BondTicker

Source: *The Wall Street Journal*, November 10, 2004, p. C12. Reprinted by permission of *The Wall Street Journal*. © 2004 Dow Jones & Company, Inc. All Rights Reserved Worldwide. **www.wsj.com**

TABLE 6-9 Bond Characteristics

Bearer Bonds—bonds on which coupons are attached. The bond holder presents the coupons to the issuer for payments of interest when they come due.

Registered Bonds—with a registered bond, the owner's identification information is recorded by the issuer and the coupon payments are mailed to the registered owner.

Term Bonds—bonds in which the entire issue matures on a single date.

Serial Bonds—bonds that mature on a series of dates, with a portion of the issue paid off on each.

Mortgage Bonds—bonds that are issued to finance specific projects that are pledged as collateral for the bond issue.

Equipment Trust Certificates—bonds collateralized with tangible non–real estate property (e.g., railcars and airplanes).

Debentures—bonds backed solely by the general credit of the issuing firm and unsecured by specific assets or collateral.

Subordinated Debentures—unsecured debentures that are junior in their rights to mortgage bonds and regular debentures.

Convertible Bonds—bonds that may be exchanged for another security of the issuing firm at the discretion of the bond holder.

Stock Warrants—bonds that give the bond holder an opportunity to purchase common stock at a specified price up to a specified date.

Callable Bonds—bonds that allow the issuer to force the bond holder to sell the bond back to the issuer at a price above the par value (at the call price).

Sinking Fund Provisions—bonds that include a requirement that the issuer retire a certain amount of the bond issue each year.

term bonds

Bonds in which the entire issue matures on a single date.

serial bonds

Bonds that mature on a series of dates, with a portion of the issue paid off on each.

mortgage bonds

Bonds issued to finance specific projects, which are pledged as collateral for the bond issue.

debentures

Bonds backed solely by the general credit of the issuing firm, unsecured by specific assets or collateral.

subordinated debentures

Bonds that are unsecured and are junior in their rights to mortgage bonds and regular debentures.

convertible bonds

Bonds that may be exchanged for another security of the issuing firm at the discretion of the bond holder.

lack of security with bearer bonds, they have largely been replaced by registered bonds in the United States.

Term versus Serial Bonds. Most corporate bonds are **term bonds,** meaning that the entire issue matures on a single date. Some corporate bonds (and most municipal bonds), on the other hand, are **serial bonds,** meaning that the issue contains many maturity dates, with a portion of the issue being paid off on each date. For economic reasons, many issuers like to avoid a "crisis at maturity." Rather than having to pay off one very large principal sum at a given time in the future (as with a term issue), many issuers like to stretch out the period over which principal payments are made—especially if the corporation's earnings are quite volatile.

Mortgage Bonds. Corporations issue **mortgage bonds** to finance specific projects that are pledged as collateral for the bond issue. Thus, mortgage bond issues are secured debt issues.[8] Bond holders may legally take title to the collateral to obtain payment on the bonds if the issuer of a mortgage bond defaults. Because mortgage bonds are backed with a claim to specific assets of the corporate issuer, they are less risky investments than unsecured bonds. As a result, mortgage bonds have lower yields to bond holders than unsecured bonds. Equipment trust certificates are bonds collateralized with tangible (movable) non–real estate property such as railcars and airplanes.

Debentures and Subordinated Debentures. Bonds backed solely by the general creditworthiness of the issuing firm, unsecured by specific assets or collateral, are called **debentures.** Debenture holders generally receive their promised payments only after the secured debt holders, such as mortgage bond holders, have been paid. **Subordinated debentures** are also unsecured, and they are junior in their rights to mortgage bonds and regular debentures. In the event of a default, subordinated debenture holders receive a cash distribution only after all nonsubordinated debt has been repaid in full. As a result, subordinated bonds are the riskiest type of bond and generally have higher yields than nonsubordinated bonds. In many cases, these bonds are termed *high-yield* or *junk bonds* because of their below investment grade credit ratings (see below).

Convertible Bonds. **Convertible bonds** are bonds that may be exchanged for another security of the issuing firm (e.g., common stock) at the discretion of the bond holder. If the market value of the securities the bond holder receives with conversion exceeds the market value of the bond, the bond holder can return the bonds to the issuer in exchange for the new securities and make a profit. As a result, conversion is an attractive option or feature to bond holders. Thus, convertible bonds are hybrid securities involving elements of both debt and equity. They give the bond holder an investment opportunity (an option) that is not available with nonconvertible bonds. As a result, the yield on a convertible bond is usually lower (generally, 2 to 5 percentage points) than that on a nonconvertible bond:

$$i_{cvb} = i_{ncvb} - op_{cvb}$$

where

i_{cvb} = Rate of return on a convertible bond
i_{ncvb} = Rate of return on a nonconvertible bond
op_{cvb} = Value of the conversion option to the bond holder

8. Open-end mortgage bonds allow the firm to issue additional bonds in the future, using the same assets as collateral and giving the same priority of claim against those assets. Closed-end mortgage bonds prohibit the firm from issuing additional bonds using the same assets as collateral and giving the same priority of claim against those assets.

EXAMPLE 6-8 Analysis of a Convertible Bond

In 2007, Titan Corporation had a convertible bond issue outstanding. Each bond, with a face value of $1,000, could be converted into common shares at a rate of 285.71 shares of stock per $1,000 face value bond (the conversion rate), or $3.50 per share. In June 2007, Titan's common stock was trading (on the NYSE) at $9.375 per share. While this might look like conversion would be very profitable, Titan's convertible bonds were trading at 267.875 percent of the face value of the bond, or $2,678.75.

To determine whether or not it is profitable to convert the bonds into common stock in Titan Corp., the conversion value of each bond can be calculated as:

$$\text{Conversion value} = \frac{\text{Current market price of common stock received on conversion}}{} \times \text{Conversion rate}$$

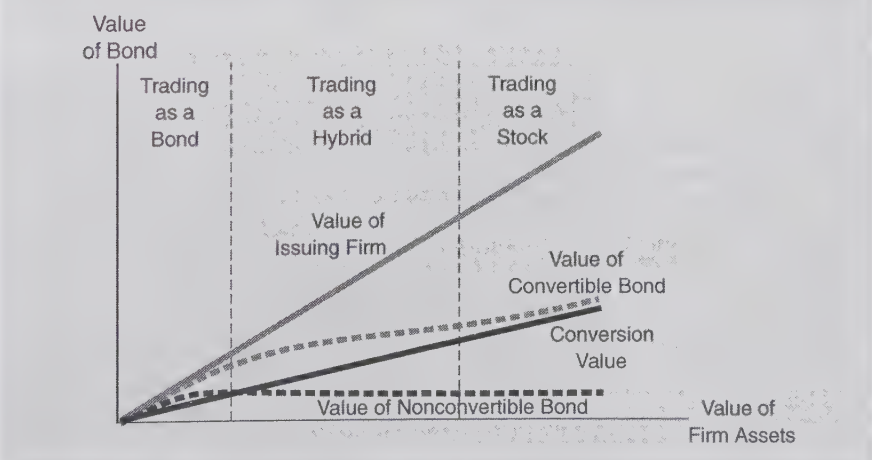
If a bond holder were to convert Titan Corp. bonds into stock, each bond (worth $2,678.75) could be exchanged for 285.71 shares of stock worth $9.375. The conversion value of the bonds is:

$$\$9.375 \times 285.71 = \$2,678.53$$

Thus, there is virtually no difference in dollar value of the investment to the investor if he or she holds Titan's debt or its common stock equivalent.

Figure 6–9 illustrates the value of a convertible bond as a function of the issuing firm's asset value. The horizontal axis plots the firm's value, which establishes an upper bound for the value of the convertible bond (since it cannot trade for more than the value of the firm's assets). Thus, the value of the issuing firm line that bisects the figure at a 45° angle also represents the issuing firm's value and sets an upper bound for the value of the convertible bond. In addition, the figure plots the values of the firm's convertible and nonconvertible bonds. At low firm values, the values of both bonds drop off as bankruptcy becomes more likely. Note that the nonconvertible bond's value does not increase at higher firm asset values since bond holders receive only their promised payments and no more. However, the convertible bond values rise directly with the firm's asset value. Specifically, at low firm asset values the convertible bond value acts more like a nonconvertible bond, trading at only a slight premium

FIGURE 6–9 Value of a Convertible Bond



over the nonconvertible bond. When the issuing firm's value is high, however, the convertible will act more like a stock, selling for only a slight premium over the conversion value. In the middle range, the convertible bond will trade as a hybrid security, acting partly like a bond and partly like a stock.

Most convertible bond issues are set up so that it is not initially profitable to convert to stock. Usually the stock price must increase 15 to 20 percent before it becomes profitable to convert the bond to the new security.

stock warrants

Bonds issued with stock warrants attached giving the bond holder an opportunity to purchase common stock at a specified price up to a specified date.

Stock Warrants. Bonds can also be issued with **stock warrants** attached. Similar to convertible bonds, bonds issued with stock warrants attached give the bond holder an opportunity to detach the warrants to purchase common stock at a prespecified price up to a prespecified date. In this case, however, if the bond holder decides to purchase the stock (by returning or exercising the warrant), the bond holder does not have to return the underlying bond to the issuer (as under a convertible bond). Instead, he or she keeps the bond and pays for additional stock at a price specified in the warrant. Bond holders will exercise their warrants if the market value of the stock is greater than the price at which the stock can be purchased through the warrant. Further, the bond holder may sell the warrant rather then exercise it, while maintaining ownership of the underlying bond. Risky firms commonly attach stock warrants to their bonds to increase the bonds' marketability. Rather than paying extremely high interest rates or accepting very restrictive bond covenants, the firm attaches stock warrants to the bonds in order to get investors to buy them.

call provision

A provision on a bond issue that allows the issuer to force the bond holder to sell the bond back to the issuer at a price above the par value (or at the call price).

call premium

The difference between the call price and the face value on the bond.

Callable Bonds. Many corporate bond issues include a **call provision,** which allows the issuer to require the bond holder to sell the bond back to the issuer at a given (call) price—usually set above the par value of the bond. The difference between the call price and the face value on the bond is the **call premium.** Many callable bond issues have a deferred call provision in which the right to call the bond is deferred for a period of time after the bond is issued (generally 10 years). Bonds are usually called in when interest rates drop (and bond prices rise) so that the issuer can gain by calling in the old bonds (with higher coupon rates) and issuing new bonds (with lower coupon rates).

For example, in 2004, DuPont had a $300 million callable debenture issue outstanding. The face value of each bond was $1,000. The issue, with a maturity date of January 15, 2023, was callable as a whole or in part not less than 30 days nor more than 60 days following January 15 of each year between the years 2005 and 2013, as listed in Table 6–10. Thus, if the bonds are called in 2008, the bond holder will receive $1,023.20 (102.32% × $1,000) per bond called in. Note that as the bond approaches maturity, the call premium declines. The closer the bond is to maturity, the smaller the premium required for forcing bond holders to give up the bonds early.

TABLE 6–10 Call Schedule for DuPont Debenture Due 2023

Year	Call Price
2005	103.47%
2006	103.09
2007	102.70
2008	102.32
2009	101.93
2010	101.54
2011	101.16
2012	100.77
2013	100.39

Source: DuPont Corporation, Annual Report, 2005.

A call provision is an unattractive feature to bond holders, since the bond holder may be forced to return the bond to the issuer before he or she is ready to end the investment and the investor can only reinvest the funds at a lower interest rate. As a result, callable bonds have higher yields (generally between 0.05 and 0.25 percent) than comparable noncallable bonds:

$$i_{ncb} = i_{cb} - op_{cb}$$

where

i_{ncb} = Rate of return on a noncallable bond
i_{cb} = Rate of return on a callable bond
op_{cb} = Value of the issuer's option to call the debt early

sinking fund provision

A requirement that the issuer retire a certain amount of the bond issue each year.

Sinking Fund Provisions. Many bonds have a **sinking fund provision,** which is a requirement that the issuer retire a certain amount of the bond issue early over a number of years, especially as the bond approaches maturity. The bond issuer provides the funds to the trustee by making frequent payments to a sinking fund. This sinking fund accumulates in value and is eventually used to retire the entire bond issue at maturity or to periodically retire a specified dollar amount of bonds either by purchasing them in the open market or by randomly calling bonds to be retired. In this case, the selected bonds are called and redeemed. Once the bonds are called they cease to earn interest. The bond holders must surrender their bonds to receive their principal.[9] For example, in 2004 May Department Stores Co. had a sinking fund debenture issue outstanding that required that the firm put $12.5 million per year from 1999 through 2017 (19 years) into a sinking fund, so that a total of $237.5 million of the $250 million principal on the bonds would be accumulated before maturity.

Since it reduces the probability of default at the maturity date, a sinking fund provision is an attractive feature to bond holders. Thus, bonds with a sinking fund provision are less risky to the bond holder and generally have lower yields than comparable bonds without a sinking fund provision.

The Trading Process for Corporate Bonds. Primary sales of corporate bond issues occur through either a public sale (issue) or a private placement in a manner identical to that discussed for municipal bonds (see above). In the first three quarters of 2004, a total of $3,927.8 billion of (corporate and municipal) debt was issued, of which $351.96 billion was privately placed.

There are two secondary markets in corporate bonds: the exchange market (e.g., the NYSE) and the over-the-counter (OTC) market. The major exchange for corporate bonds is the New York Stock Exchange Fixed Income Market. Most of the trading on the NYSE's bond market is completed through its Automated Bond System (ABS), which is a fully automated trading and information system that allows subscribing firms to enter and execute bond orders through terminals in their offices. Users receive immediate execution reports and locked-in prices on their trades. Notice, however, the small amount of trading volume reported for NYSE bonds in Table 6–8. The average daily dollar value of bond trading totaled $13.5 billion in 2004 in a market with $6.73 trillion of bonds outstanding. This is because less than 1 percent of all corporate bonds trade on exchanges such as the NYSE.

Most bonds are traded OTC among major bond dealers such as Salomon Smith Barney and UBS Paine Webber. The OTC direct, interdealer market totally dominates trading in corporate bonds. Virtually all large trades are carried out on the OTC market, even for bonds listed on an exchange, such as the NYSE bond market. Thus, prices reported on the exchanges (like those in Table 6–8) are generally considered to be inexact estimates of prices associated with large transactions. Thus, in contrast to Treasury securities, secondary market trading of corporate bonds can involve a significant degree of liquidity risk.

9. If the bond holder does not turn the bonds in for redemption, they continue to be outstanding and are obligations of the issuer. However, the issuer's obligation is limited to refunding only the principal, since interest payments stopped on the call date.

TABLE 6–11 Bond Credit Ratings

Explanation	Moody's	S&P
Best quality; smallest degree of risk	Aaa	AAA
High quality; slightly more long-term risk than top rating	Aa1	AA+
	Aa2	AA
	Aa3	AA−
Upper medium grade; possible impairment in the future	A1	A+
	A2	A
	A3	A−
Medium grade; lack outstanding investment characteristics	Baa1	BBB+
	Baa2	BBB
	Baa3	BBB−
Speculative issues; protection may be very moderate	Ba1	BB+
	Ba2	BB
	Ba3	BB−
Very speculative; may have small assurance of interest and principal payments	B1	B+
	B2	B
	B3	B−
Issues in poor standing; may be in default	Caa	CCC
Speculative in a high degree; with marked shortcomings	Ca	CC
Lowest quality; poor prospects of attaining real investment standing	C	C
		D

Source: Moody's and Standard & Poor's Web sites. **www.moodys.com; www.standardandpoors.com**

Bond Ratings

As mentioned above, the inability of investors to get information pertaining to the risk, especially default risk, on bonds, at a reasonable cost, can result in thinly traded markets. In Chapter 3, we examined the impact of interest rate risk (i.e., interest rate changes) on bond prices. Specifically, we demonstrated that bonds with longer maturities (durations) and low coupon rates experience larger price changes for a given change in interest rates than bonds with short maturities and high coupon rates (i.e., bonds with longer maturities and lower coupon rates are subject to greater interest rate risk). As important, bond investors also need to measure the degree of default risk on a bond.

Large bond investors, traders, and managers often evaluate default risk by conducting their own analysis of the issuer, including an assessment of the bond issuer's financial ratios (see Chapter 20) and security prices. Small investors are not generally capable of generating the same extensive information and thus frequently rely on bond ratings provided by the bond rating agencies. The two major bond rating agencies are Moody's and Standard & Poor's (S&P).[10] Both companies rank bonds based on the perceived probability of issuer default and assign a rating based on a letter grade. Table 6–11 summarizes these rating systems and provides a brief definition of each. The highest credit quality (lowest default risk) that rating agencies assign is a triple-A (Aaa for Moody's and AAA for S&P). Bonds with a triple-A rating have the lowest interest spread over similar maturity Treasury securities. As the assessed default risk increases, Moody's and S&P lower the credit rating assigned on a bond issue, and the interest spread over similar maturity Treasuries paid to bond holders generally increases.[11] Figure 6–10 shows the

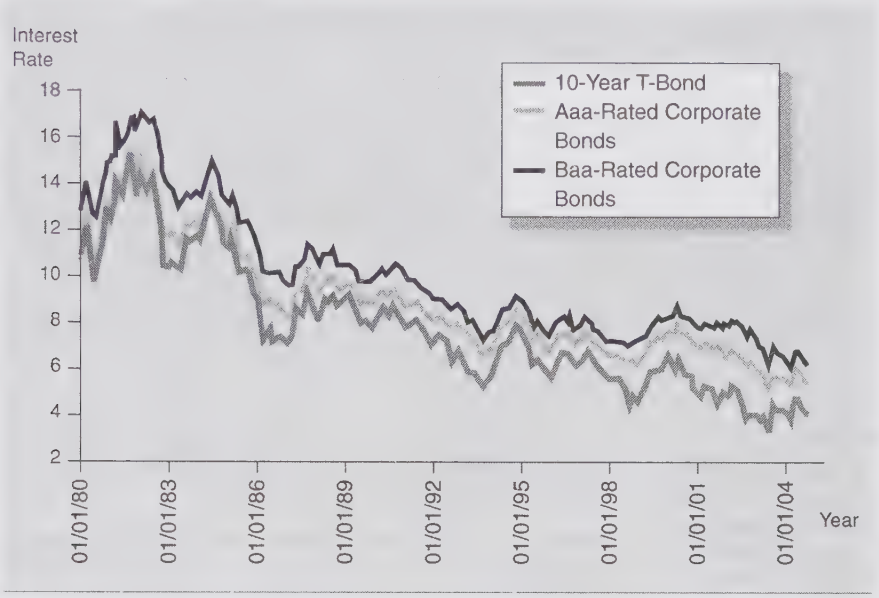
www.moodys.com

www.standardandpoors.com

10. Other credit rating agencies include Fitch IBCA, Inc. **(www.fitchibca.com)** and Duff and Phelps Credit Rating Services **(www.duffIle.com).**

11. Note that S&P and Moody's sometimes disagree on ratings (recently differences occur about 15 percent of the time). When this occurs, a bond is said to have a "split" rating.

FIGURE 6–10 Rates on Treasury Bonds, Aaa-Rated Bonds, and Baa-Rated Bonds



Source: Federal Reserve Board Web site, "Research and Data," November 2004. **www.federalreserve.gov**

rates on 10-year Treasury securities versus Aaa-rated and Baa-rated bonds from 1980 through October 2004. The risk premium over this period on Aaa-rated bonds was 1.06 percent and on Baa-rated bonds was 2.16 percent. The cumulative default rates on these bonds over a 10-year period after issuance is 0.03 percent on Aaa-rated bonds and 9.63 percent on Baa-rated bonds.[12]

Rating agencies consider several factors in determining and assigning credit ratings on bond issues. For example, a financial analysis is conducted of the issuer's operations and its needs, its position in the industry, and its overall financial strength and ability to pay the required interest and principal on the bonds. Rating agencies analyze the issuer's liquidity, profitability, debt capacity, and more recently its corporate governance structure (following the passage of the Sarbanes-Oxley Act in 2002—see Chapter 9). Then for each particular issue, rating agencies evaluate the nature and provisions of the debt issue (e.g., the covenants and callability of the bond) and the protection afforded by, and relative position of, the debt issue in the event of bankruptcy, reorganization, or other arrangements under the laws of bankruptcy and other laws affecting creditors' rights. However, in recent years rating agencies have been criticized as slow to react. Perhaps the best example of this was the failure to downgrade Enron (the second-largest corporate bankruptcy in U.S. history) in the months leading up to its failure in 2001.

As a practical matter, a bond needs to be rated if it is to be used as an investment vehicle by certain institutional investors. Bonds rated Baa or better by Moody's and BBB or better by S&P are considered to be investment-grade bonds. Financial institutions (e.g., banks,

12. See E. I. Altman and B. Karlin, "Default and Returns on High-Yield Bonds: Analysis through 2003 and Default Outlook," working paper, New York University Salomon Center, May 2004. A cumulative default rate reflects annual default rates over time. If a bond has a 99 percent chance of surviving default in the first year of its life and 98 percent in its second year, then the two-year cumulative default rate (CDR) = 1 − [(.99) × (.98)] = .0298, or 2.98%.

TABLE 6–12 Major Bond Market Indexes

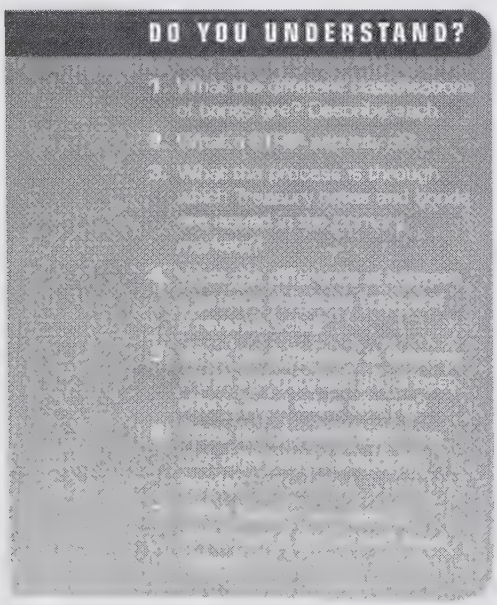
Major Bond Indexes

U.S. Treasury Securities Lehman Brothers	CLOSE	NET CHG	% CHG	52-WEEK HIGH	52-WEEK LOW	52-WEEK % CHG	YTD % CHG
Intermediate	7711.97	+3.43	+0.04	7752.62	7414.07	+3.18	+2.90
Long-term	12831.36	+40.62	+0.32	12912.12	11522.05	+7.58	+7.83
Composite	8841.39	+10.27	+0.12	8890.43	8374.44	+4.39	+4.27
Broad Market Lehman Brothers (preliminary)							
U.S. Aggregate	1105.93	+1.35	+0.11	1108.18	1040.43	+5.78	+4.10
U.S. Gov't/Credit	1280.02	+1.68	+0.12	1284.86	1202.77	+5.81	+4.01
U.S. Corporate Debt Issues Merrill Lynch							
Corporate Master	1510.34	+2.20	+0.15	1511.31	1410.52	+5.60	+4.98
High Yield	713.60	+1.28	+0.18	713.60	635.21	+12.34	+9.29
Yankee Bonds	1098.53	+1.43	+0.13	1100.66	1029.81	+5.09	+4.67
Mortgage-Backed Securities current coupon; Merrill Lynch: Dec. 31, 1986=100							
Ginnie Mae	445.84	+0.68	+0.15	445.84	413.50	+6.18	+5.84
Fannie Mae	444.67	+0.89	+0.20	444.67	416.12	+5.07	+4.67
Freddie Mac	272.09	+0.50	+0.18	272.09	254.70	+5.45	+4.88
Tax-Exempt Securities Merrill Lynch; Dec. 22, 1999							
6% Bond Buyer Muni	111.09	−0.66	−0.59	133.88	104.94	−0.31	−1.03
7-12 Yr G.O.	203.24	+0.22	+0.11	205.36	187.76	+4.96	+3.90
12-22 Yr G.O.	216.03	+0.16	+0.07	218.02	199.83	+5.49	+4.30
22+ Yr Revenue	203.88	+0.35	+0.17	204.36	188.50	+5.16	+3.91

Source: *The Wall Street Journal*, November 19, 2004, p. C2. Reprinted by permission of *The Wall Street Journal*. © 2004 Dow Jones & Company, Inc. All Rights Reserved Worldwide. **www.wsj.com**

junk bond

Bond rated as speculative or less than investment grade (below Baa by Moody's and BBB by S&P) by bond-rating agencies.



insurance companies) are generally prohibited by state and federal law from purchasing anything but investment-grade bond securities.[13] Bonds rated below Baa by Moody's and BBB by S&P are considered to be speculative-grade bonds and are often termed **junk bonds,** or high-yield bonds.[14] The issuance of speculative bonds was rare prior to the economic downturn of the late 1970s. Given the risk involved with speculative bonds and the ready availability of investment-grade bonds, investment banks had a difficult time marketing the more speculative bonds to primary bond market investors. The market grew significantly in the late 1990s, with smaller and medium-sized firms, unqualified to issue investment-grade debt securities, issuing long-term debt in this market. For example, in 1990, $503.3 million in corporate "high-yield" straight debt was issued. In just the first three quarters of 2004, $117.5 billion was issued.

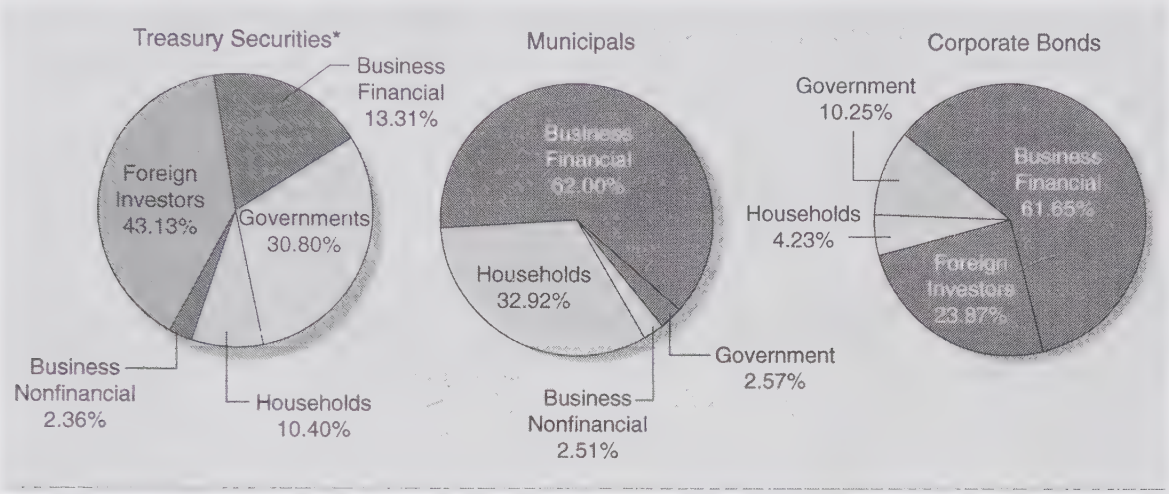
Bond Market Indexes

Table 6–12 lists major bond market indexes as of November 18, 2004. Data in this table give investors general information on returns of bonds from various types of issuers (e.g., Treasuries, municipals, and corporate bonds) and various maturities. The indexes are those managed by major investment banks (e.g., Lehman Brothers, Merrill Lynch) and reflect both the monthly capital gain and loss on bonds in the index plus any interest (coupon) income earned. Changes in the values of these broad market indexes can be used by bond traders to evaluate changes in the investment attractiveness of bonds of different types and maturities.

13. For example, the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 rescinded the ability of savings associations to purchase and hold below-investment-grade bonds (see Chapter 13).

14. A bond downgraded from investment-grade status (e.g., BBB) to junk bond status (e.g., B) is called a "fallen angel."

FIGURE 6–11 Bond Market Securities Held by Various Groups of Market Participants, September 2004



*Includes Treasury bills, notes, and bonds.

Source: Federal Reserve Board Web site, "Flow of Funds Accounts," November 2004. **www.federalreserve.gov**

3 BOND MARKET PARTICIPANTS

Bond markets bring together suppliers and demanders of long-term funds. We have just seen that the major issuers of debt market securities are federal, state, and local governments and corporations. The major purchasers of capital market securities are households, businesses, government units, and foreign investors. Figure 6–11 shows the percentage of each type of bond security held by each of these groups. Notice that financial firms called "business financial" (e.g., banks, insurance companies, mutual funds) are the major suppliers of funds for two of the three types of bonds. Financial firms hold 13.31 percent of all Treasury notes and bonds, 62.00 percent of municipal bonds, and 61.65 percent of the corporate bonds outstanding. In addition to their direct investment reported in Figure 6–11, households often deposit excess funds in financial firms (such as mutual bond funds and pension funds) that use these funds to purchase bond market securities. Thus, much of the business and financial holdings of bond securities shown in Figure 6–11 reflects indirect investments of households in the bond market.

DO YOU UNDERSTAND?

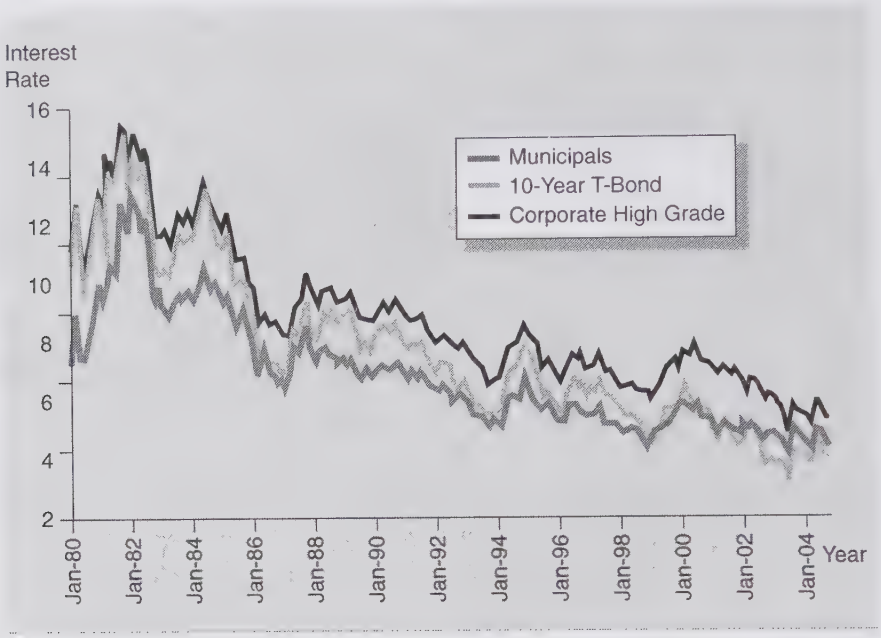
COMPARISON OF BOND MARKET SECURITIES

www.stlouisfed.org

Figure 6–12 shows the yield to maturity on various types of bonds (e.g., 10-year Treasury bonds, municipal bonds, and high-grade corporate bonds) from 1980 through 2004. While the general trends in yields were quite similar over this period (i.e., yield changes are highly correlated), yield spreads among bonds can vary as default risk, tax status, and marketability change. For example, yield spread differences can change when characteristics of a particular type of bond are perceived to be more or less favorable to the bond holder (e.g., relative changes in yield spreads can result when the default risk increases for a firm that has one bond issue with a sinking fund provision and another issue without a sinking fund issue). Economic conditions can also cause bond yield spreads to vary over time. This is particularly true during periods of slow economic growth (e.g., 1982 and 1989–1991), as investors require higher default risk premiums.

DO YOU UNDERSTAND?

FIGURE 6–12 Yields on Bond Market Securities, 1980–2004



Source: Federal Reserve Board Web site, "Research and Data," November 2004. **www.federalreserve.gov**

The St. Louis Federal Reserve Bank offers free online access to its database (called FRED) of U.S. economic and financial data, including daily U.S. interest rates, monetary business indicators, exchange rates, balance of payments, and regional economic data.

4 INTERNATIONAL ASPECTS OF BOND MARKETS

International bond markets are those markets that trade bonds that are underwritten by an international syndicate, offer bonds to investors in different countries, issue bonds outside the jurisdiction of any single country, and offer bonds in unregistered form. The rapid growth in international bond markets in recent years can be seen in Table 6–13, which lists the dollar volume of new issues of international bond securities from 1994 through 2004. Much of this growth has been driven by investors' demand for international securities and international portfolio diversification (e.g., the growth of specialized U.S. mutual funds that invest in offshore bond issues). In just seven years, new issues have grown from $253.6 billion (in 1994) to $1,472.4 billion (in 2003) and $868.5 billion (in just the first half of 2004). The majority of this growth has been debt issued by developed countries (e.g., the U.S. and Europe). Notice the drop in debt securities issued by Japan and by "Other countries" (i.e., emerging market countries such as Thailand and Singapore) after the economic crisis in Southeast Asia in 1997. For example, (net) new debt issues for Japan were negative in every year reported in Table 6–13 except the first six months of 2004 (meaning that more Japanese notes and bonds were redeemed than issued). New debt issues in "Other countries" fell from $89.2 billion in 1997 to $42.8 billion in 2004 before rising to $66.9 billion in 2003 and $42.8 billion in the first half of 2004. Notice also the sharp increase in new euro-denominated debt issues in 1997, $257.9 billion, as investors attempted to position themselves before the introduction of the euro in 1999. This number rose even higher, to $559.9 billion in 2000, $756.2 billion in 2003, and $444.9 billion in the first six months of 2004, as the euro began circulating. Indeed, in the fourth

TABLE 6–13 International Debt Securities Issued, 1994–2004
(in billions of U.S. dollars)

	1994	1997	2000	2003	2004*
Total net issues	$253.6	$573.3	$1,243.4	$1,472.4	$868.5
Money market instruments	3.3	19.8	152.1	75.4	37.6
Bonds and notes	250.3	553.5	1,091.3	1,397.0	830.9
Developed countries	205.5	449.0	1,163.1	1,365.9	802.7
Euro area	167.1	257.9	559.9	756.2	444.9
Japan	−5.9	−0.4	−25.8	−1.0	17.3
United States	22.9	176.9	467.2	275.6	133.3
Offshore centers	7.2	14.5	15.0	16.3	5.9
Other countries	32.5	89.2	42.8	66.9	42.8
International institutions	8.5	20.6	22.6	23.2	17.1
Financial institutions	136.1	360.0	802.8	1,188.6	699.4
Public sector	103.1	89.0	267.9	170.5	150.8
Corporate issuers	14.4	124.3	172.7	113.3	18.3

*Through second quarter.

Source: Bank for International Settlements, Quarterly Review, various issues. **www.bis.org**

quarter of 2001, just before the full implementation of the euro, debt securities issued by euro-area countries rose 75 percent compared to third quarter issuances, from $66 billion to $155 billion. In contrast, debt securities issued in the United States decreased 8 percent (from $222 billion in the third quarter of 2001 to $210 billion in the fourth quarter) and net Japanese issuances were negative in both quarters.

Table 6–14 lists the values of international debt outstanding by currency and type (e.g., floating-rate, straight fixed-rate, and equity-related debt) from 1995 through 2004. In June 2004, international bonds and notes outstanding totaled over $11.7 trillion, compared to $2.2 trillion in 1995. Straight fixed-rate securities dominate the market, mainly because of the strong demand for dollar and euro currency assets. Floating-rate notes were second in size, partly as a result of interest rate uncertainty in the late 1990s and early 2000s.

Notice that prior to 2004 a majority of international debt instruments were denominated in U.S. dollars. For example, in December 2000, some 53.3 percent of the floating-rate debt, 48.0 percent of the straight fixed-rate debt, and 53.6 percent of the equity-related debt was denominated in U.S. dollars. The U.S. dollar was the currency of choice as an international medium of exchange and store of value. However, euro-denominated debt outstanding surpassed the U.S. dollar as the main currency in which international debt is denominated. In 2004, 51.5 percent of floating-rate debt, 41.0 percent of straight fixed-rate debt, and 38.5 percent of equity-related debt outstanding was issued in euros. Thus, since its introduction the euro has surpassed the Japanese yen and the U.S. dollar as the lead currency with which debt issues are denominated. Notice too from Table 6–14 that the markets for emerging-country bonds (other currencies) have recovered from the Asian crisis of the late 1990s. Fear of losses on holdings of these emerging market bonds sparked a wide selloff in the emerging markets in the late 1990s and early 2000s.[15]

15. For example, Argentina had severe economic and financial problems in the early 2000s that culminated in an $82 billion default in government bonds in 2002. However, Argentina's problems did not seem to spread to other Latin American countries, nor did they cause significant disruption in global financial markets. Most of Argentina's creditors appeared to have been successful in reducing their exposures to acceptable levels in the months preceding defaults of Argentine debt issues. As a result, creditors were able to absorb the default without having to sell off a large number of other sovereign bonds to cover Argentine-related losses

TABLE 6–14 International Bonds and Notes Outstanding, 1995–2004
(in billions of U.S. dollars)

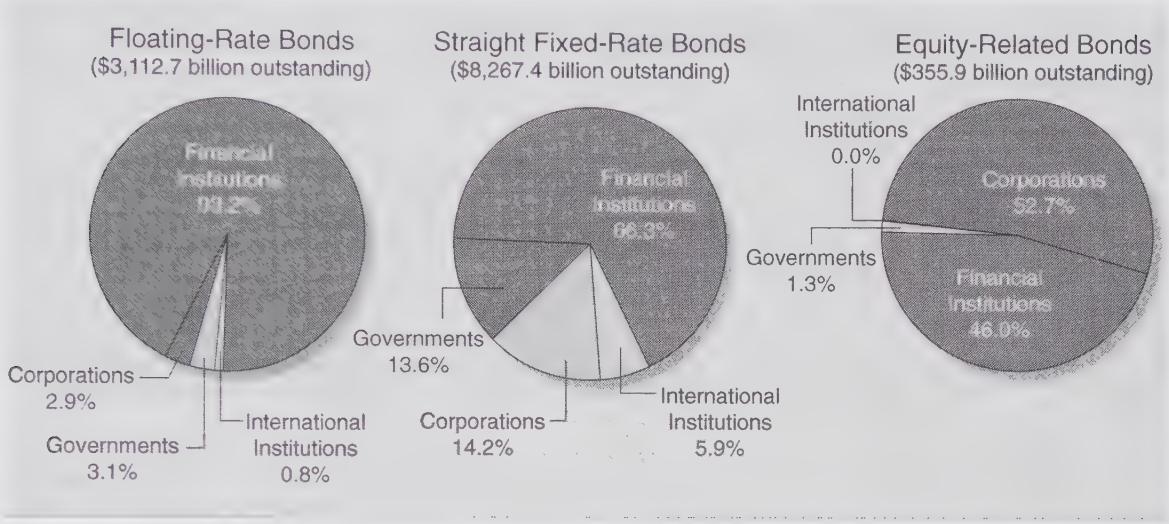
Type, Position, and Currency	1995	1997	2003	2004*
Total Issues	$2,209.3	$3,322.8	$5,884.0	$11,736.0
Floating Rate	326.2	735.7	1,482.9	3,112.7
U.S. dollar	181.5	442.1	790.0	1,111.8
Euro	44.2	130.9	471.9	1,604.3
Japanese yen	27.0	69.6	86.3	105.4
Pound sterling	N/A	N/A	112.4	224.5
Other currencies	73.6	93.0	22.3	66.7
Financial institutions	203.2	535.0	1,288.7	2,899.9
Government and state agencies	61.9	83.1	90.9	96.3
International institutions	18.4	26.9	21.3	24.9
Corporate issuers	42.8	90.7	82.0	91.7
Straight Fixed Rate	1,712.4	2,389.8	4,158.8	8,267.4
U.S. dollar	490.8	890.2	1,994.5	3,446.3
Euro	214.4	693.1	1,225.6	3,386.3
Japanese yen	315.4	368.7	352.2	356.2
Pound sterling	N/A	N/A	331.9	623.4
Other currencies	691.9	437.7	254.6	455.2
Financial institutions	501.4	894.8	2,068.7	5,485.5
Government and state agencies	492.8	621.3	1,080.3	1,123.3
International institutions	268.3	272.6	353.5	488.4
Corporate issuers	449.3	601.1	656.3	1,170.3
Equity Related†	170.7	197.4	242.3	355.9
U.S. dollar	83.1	123.0	129.8	148.6
Euro	10.7	25.0	74.6	136.9
Japanese yen	7.4	14.8	16.6	39.2
Pound sterling	N/A	N/A	8.8	11.6
Other currencies	69.5	34.7	12.4	19.6
Financial institutions	32.5	45.3	115.4	163.6
Government and state agencies	0.4	5.9	2.1	4.6
International institutions	—	0.1	0.2	—
Corporate issuers	137.7	146.1	124.6	187.7

*As of June.
†Convertible bonds and bonds with equity warrants.
N/A = not available.
Source: Bank for International Settlements, *Quarterly Review*, various issues. **www.bis.org**

DO YOU UNDERSTAND?

Figure 6–13 illustrates the distribution of international bonds by type of issuer (e.g., financial institutions, governments). Financial institutions issue the vast majority of floating-rate bonds (93.2 percent) and most of the straight fixed-rate bonds (66.3 percent). Financial institutions had been hampered in 1998 by concerns over their exposures to lower-rated countries. The stabilization of market conditions in 1999 and the early 2000s made it easier for U.S. and European financial institutions to issue new debt securities. Public sector issues were largely accounted for by U.S. financing agencies and a few emerging market issues. Corporations, as might be expected, issue the majority of the equity-related bonds (52.7 percent).

FIGURE 6–13 Distribution of International Bonds Outstanding by Type of Issuer, June 2004



Source: Bank for International Settlements, *Quarterly Review*, September 2004. **www.bis.org**

4 EUROBONDS, FOREIGN BONDS, AND BRADY AND SOVEREIGN BONDS

International bonds can also be classified into three main groups: Eurobonds, foreign bonds, and Brady and sovereign bonds.

Eurobonds

Eurobonds are long-term bonds issued and sold outside the country of the currency in which they are denominated (e.g., dollar-denominated bonds issued in Europe or Asia)[16]. Perhaps confusingly, the term *Euro* simply implies the bond is issued outside the country in whose currency the bond is denominated. Thus, "Euro"-bonds are issued in countries outside of Europe and in currencies other than the euro. Indeed, the majority of issues are still in U.S. dollars and can be issued in virtually any region of the world. Eurobonds were first sold in 1963 as a way to avoid taxes and regulation. U.S. corporations were limited by regulations on the amount of funds they could borrow domestically (in the United States) to finance overseas operations, while foreign issues in the United States were subject to a special 30 percent tax on their coupon interest. In 1963, these corporations created the Eurobond, by which bonds were denominated in various currencies and were not directly subject to U.S. regulation. Even when these regulations were abandoned, access to a new and less-regulated market by investors and corporations created sufficient demand and supply for the market to continue to grow.

Eurobonds are generally issued in denominations of $5,000 and $10,000. They pay interest annually using a 360-day year (floating-rate Eurobonds generally pay interest every six months on the basis of a spread over some stated rate, usually the LIBOR rate). Eurobonds are generally *bearer* bonds and are traded in the over-the-counter markets, mainly in London and Luxembourg. Historically, they have been of interest to smaller investors who want to shield the ownership of securities from the tax authorities.

16. A Eurobond does not have to be issued in Europe.

The classic investor is the "Belgian dentist" who would cross the border to Luxembourg on the coupon date to collect his coupons without the knowledge of the Belgian tax authority. However, today small investors—of the Belgian dentist type—are overshadowed in importance by large investors such as mutual and pension funds. Ratings services such as Moody's and Standard & Poor's generally rate Eurobonds. Equity-related Eurobonds are convertible bonds (bonds convertible into equity) or bonds with equity warrants attached.

www.moodys.com

www.standardandpoors.com

Eurobonds are placed in primary markets by investment banks. Often, a syndicate of investment banks works together to place the Eurobonds. Most Eurobonds are issued via firm commitment offerings, although the spreads in this market are much larger than for domestic bonds because of the need to distribute the bonds across a wide investor base often covering many countries. Thus, the underwriters bear the risk associated with the initial sale of the bonds. The Eurobond issuer chooses the currency in which the bond issue will be denominated. The promised payments of interest and principal must then be paid in this currency. Thus, the choice of currency, and particularly the level and volatility in the interest rates of the country of the currency, affect the overall cost of the Eurobond to the bond issuer and the rate of return to the bond holder.

The full introduction of the euro in 2002 has certainly changed the structure of the Eurobond market. Most obvious is that Eurobonds denominated in the individual European currencies no longer exist but rather are denominated in a single currency, the euro. Further, liquidity created by the consolidation of European currencies allows for the demand and size of euro-denominated Eurobond issues to increase. Such growth was exhibited early in the life of the euro (or the European currency unit (ECU) prior to 2002) as the volume of new Euro debt issues in the first and second quarter of 1999 rose 32 percent and 43 percent, respectively, from the same periods in 1998. In January 1999, a record $415 billion in long-term Eurobonds were issued. In 2000 and 2001, a total of $989.1 billion long-term Eurobonds were issued, and in 2003 alone $756.2 billion of long-term Eurobonds were issued. Finally, Eurobond yields across the European countries should vary only slightly, which should improve euro-denominated securities' marketability even further.

Foreign Bonds

Foreign bonds are long-term bonds issued by firms and governments outside of the issuer's home country and are usually denominated in the currency of the country in which they are issued rather than in their own domestic currency—for example, a Japanese company issuing a dollar-denominated public bond rather than a yen-denominated bond in the United States. Foreign bonds were issued long before Eurobonds and, as a result, are frequently called traditional international bonds. Countries sometimes name their foreign bonds to denote the country of origin. For example, foreign bonds issued in the United States are called Yankee bonds, foreign bonds issued in Japan are called Samurai bonds, and foreign bonds issued in the United Kingdom are called Bulldog bonds.

Brady bonds

Bonds that are swapped for an outstanding loan to a less developed country.

Brady Bonds and Sovereign Bonds

Brady bonds were created in the mid-1980s through International Monetary Fund (IMF) and central bank–sponsored programs under which U.S. and other banks[17] exchanged their dollar loans to emerging market countries for dollar bonds issued by the relevant countries (e.g., the Philippines, Mexico, Brazil). These bonds had a much longer maturity than that promised on the original loans and a lower promised original coupon (yield) than the interest rate on the

17. Major market makers include the Dutch ING Bank, Lehman Brothers, Salomon Smith Barney, Citibank,J. P. Morgan Chase, Bankers Trust, and Merrill Lynch.

TABLE 6–15 Loan for Bond Swaps Achieved through the Brady Plan
(in billions of dollars)

	[illegible]	[illegible]
Argentina	$29.9	$6.8
Brazil	45.6	17.8
Bulgaria	8.1	2.4
Costa Rica	0.5	0.4
Cote d'Ivoire	2.4	2.2
Dominican Republic	0.5	0.5
Ecuador	8.0	0.0
Mexico	33.0	1.3
Nigeria	5.8	1.4
Peru	10.6	2.5
Philippines	4.5	1.1
Poland	14.0	2.8
Russia	24.1	0.0
Uruguay	0.6	0.5
Venezuela	19.3	7.7
Total	202.2	47.4

Source: J. A. Penicock Jr., "Emerging Market Debt," working paper, Conference on Integrated Risk and Return Management for Insurance Companies, New York Salomon Center, May 1999, and World Bank Web site, November 2004. **www.worldbank.org**

original loan. In many cases, the bond's principal and interest payments have been partially backed by U.S. T-bonds as collateral to improve their attractiveness to investors.[18] Once banks and other financial institutions have swapped loans for bonds, they can sell them on the secondary market.

Approximately $211.1 billion of less developed countries (LDC) loans had been converted into bonds under the Brady Plan by 1998, with the top issuers being Brazil (22.1 percent), Mexico (16.0 percent), Argentina (14.5 percent), Russia (11.7 percent), and Venezuela (12.1 percent). Table 6–15 lists the size of loan for Brady bond swaps through 1998 and the amount still outstanding in 2004. These bond-for-loan swap programs seek to restore LDCs' creditworthiness and thus the value of bank holdings of such debt by creating longer-term, lower-fixed-interest, but more liquid securities in place of shorter-term, floating-rate loans.[19]

DO YOU UNDERSTAND?

More recently, as the credit quality of some LDCs has improved, some Brady bonds have been converted back into **sovereign bonds,** whereby U.S. Treasury bond collateral backing is removed and the creditworthiness of the country is substituted instead. For example, in April 2003 Mexico sold $2.5 billion of sovereign bonds to help finance the repurchase of the country's U.S. dollar–denominated Brady bonds. Spreads over Treasuries on these bonds are much higher than on Brady bonds (often in the 4 percent plus range). However, countries save by not having to pledge U.S. dollar Treasury bonds as collateral against principal and interest payments.

sovereign bonds
A bond that is swapped for an outstanding loan to a less developed country (LDC), in which the U.S. Treasury secondary collateral backing is removed and the creditworthiness of the country is substituted instead.

18. For example, the face value payment of a 30-year Brady bond may be backed by the issuing government placing a 30-year U.S. zero-coupon T-bond as collateral in an escrow account. Should the issuing government default on its Brady bond, investors would have a claim to the 30-year zero-coupon Treasury bond as collateral.

19. However, even after restructuring their debt into Brady bonds, Russia and Ecuador defaulted on their outstanding Brady bonds in 1999.

SUMMARY

This chapter looked at the domestic and international bond markets. We defined and discussed the three types of bonds available to long-term debt investors: Treasury notes and bonds, municipal bonds, and corporate bonds. We also reviewed the process through which bonds trade in both primary and secondary bond markets. International bond markets have grown dramatically in recent years. We documented and offered some reasons for this growth. We concluded the chapter with a description of the different types of international bonds: the traditional foreign bonds, the relatively new Eurobonds, Brady bonds, and sovereign bonds.

SEARCH THE SITE

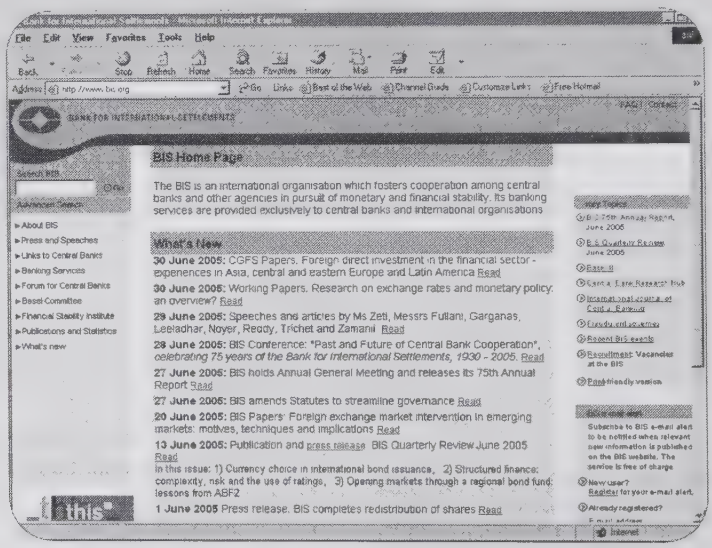
Go to the Bank for International Settlements Web site at **www.bis.org** and find the most recent data on the issue of new international debt and the current distribution of international bonds by type of issuer using the following steps.

Click on "BIS Quarterly Review"

Click on "Statistical annex Read"

Click on "securities market"

This will bring the file onto your computer that contains the relevant data in Tables 12B and 13B.



Questions

1. How have these values changed since 2004 reported in Tables 6–13 and 6–14?
2. Calculate the percentage of floating rate, straight fixed rate, and equity related bonds issued in U.S. dollars and Euros.

QUESTIONS

1. What are capital markets and how do bond markets fit into the definition of capital markets?
2. What is the difference between T-bills, T-notes, and T-bonds?
3. Refer to the T-note and T-bond quote in Table 6–1.
   a. What is the asking price on the 9.25 percent February 2016 T-bond if the face value of the bond is $10,000?
   b. What is the bid price on the 6.5 percent August 2005 T-note if the face value of the bond is $10,000?
4. Refer again to Table 6–1.
   a. Verify the ASKED price on the 2.750 percent July 2006 T-note for Tuesday, November 9, 2004. The ASK YLD on the note is 2.71 percent and the note matures on July 31, 2006. Settlement occurs two business days after purchase; i.e., you would take possession of the note on November 11, 2004.
   b. Verify the ASK YLD on the 4.00 percent February 2014 T-note for Tuesday, November 9, 2004. The ASKED price is 98:19 and the note matures on February 28, 2014.

5. What is a STRIP? Who would invest in a STRIP?
6. Refer to Table 6–1.
   a. Verify the Tuesday, November 9, 2004 ASK YLD on the principal (np) STRIP maturing in November 2006. Use a two-day settlement period from the date of purchase (i.e., ownership occurs on November 6, 2004). The STRIP matures on November 30, 2006.
   b. Verify the ASKED price on the principal (np) STRIP maturing in August 2009, i.e., the STRIP matures on August 15, 2009.
7. On October 5, 2007, you purchase a $10,000 T-note that matures on August 15, 2018 (settlement occurs two days after purchase, so you receive actual ownership of the bond on October 7, 2007). The coupon rate on the T-note is 4.375 percent and the current price quoted on the bond is 105:08 (or 105.25% of the face value of the T-note). The last coupon payment occurred on May 15, 2007 (145 days before settlement), and the next coupon payment will be paid on November 15, 2007 (39 days from settlement).
   a. Calculate the accrued interest due to the seller from the buyer at settlement.
   b. Calculate the dirty price of this transaction.
   c. Calculate the yield to maturity (based on the clean price) on the bond received on October 7, 2007, and maturing on August 15, 2018 (or in 10.8603 years).
8. You can invest in taxable bonds that are paying a 9.5 percent annual rate of return or a municipal bond paying a 7.75 percent annual rate of return. If your marginal tax rate is 21 percent, which security bond should you buy?
9. A municipal bond you are considering as an investment currently pays a 6.75 percent annual rate of return.
   a. Calculate the tax equivalent rate of return if your marginal tax rate is 28 percent.
   b. Calculate the tax equivalent rate of return if your marginal tax rate is 21 percent.
10. What is the difference between general obligation bonds and revenue bonds?
11. Refer to Table 6–6.
   a. On November 9, 2004, what were the coupon rate, price, and yield on municipal bonds issued by the Texas Turnpike-Authority?
   b. What was the price, on November 8, 2004, on Montgomery County, Ohio bonds maturing in May 2030?
12. Refer to Table 6–8.
   a. What was the price on the Ford Motor Credit Corporation 7.25 percent coupon bonds on November 9, 2004?
   b. What was the dollar volume of trading in General Electric 5.0 percent coupon bonds maturing in 2013 on November 9, 2004?
   c. What was the price on CIT Group bonds on November 4, 2004?
13. **Using a Spreadsheet to Calculate Bond Values:** What is the bond quote for a $1,000 face value bond with an 8 percent coupon rate (paid semiannually) and a required return of 7.5 percent if the bond is 6.48574, 8.47148, 10.519, and 14.87875 years from maturity?

Face Value	Total Payments	Periodic Coupon Payment	Required Return	=>	The Bond Value Will Be
100%	6.48574 × 2 = 12.97148	8%/2 = 4%	7.5%		102-17%
100	8.47148 × 2 = 16.94296	4	7.5		103-03
100	10.519 × 2 = 21.0380	4	7.5		103-19
100	14.87875 × 2 = 29.7575	4	7.5		104-14

14. What is the difference between bearer bonds and registered bonds?
15. What is the difference between term bonds and serial bonds?
16. Which type of bond—a mortgage bond, a debenture, or a subordinated debenture—generally has the
   a. Highest cost to the bond issuer?
   b. Least risk to the bond holder?
   c. Highest yield to the bond holder?
17. What is a convertible bond? Is a convertible bond more or less attractive to a bond holder than a nonconvertible bond?
18. Hilton Hotels Corp. has a convertible bond issue outstanding. Each bond, with a face value of $1,000, can be converted into common shares at a rate of 61.2983 shares of stock per $1,000 face value bond (the conversion rate), or $16.316 per share. Hilton's common stock is trading (on the NYSE) at $15.90 per share and the bonds are trading at $975.
   a. Calculate the conversion value of each bond.
   b. Determine if it is currently profitable for bond holders to convert their bonds into shares of Hilton Hotel common stock.
19. What is a callable bond? Is a call provision more or less attractive to a bond holder than a noncallable bond?
20. Explain the meaning of a sinking fund provision on a bond issue.
21. What is the difference between an investment-grade bond and a junk bond?
22. STANDARD &POOR'S Go to the S&P Educational Version of Market Insight Web site at **www.mhhe.com/edumarketinsight** and find the S&P credit rating for Boeing Corp. (BA) and Texas Instruments (TXN) using the following steps. Click on "Educational Version of Market Insight." Enter your Site ID and click on "Login." Click on "Company." In the box marked "Ticker" enter BA and click on "Go!" Under Compustat Reports click on "Financial Hlts." This brings up a file that contains the relevant data. Repeat this process using the ticker TXN.
23. What is the difference between a Eurobond and a foreign bond?
24. How are Brady bonds created?

Chapter 6

Mortgage Markets

OUTLINE

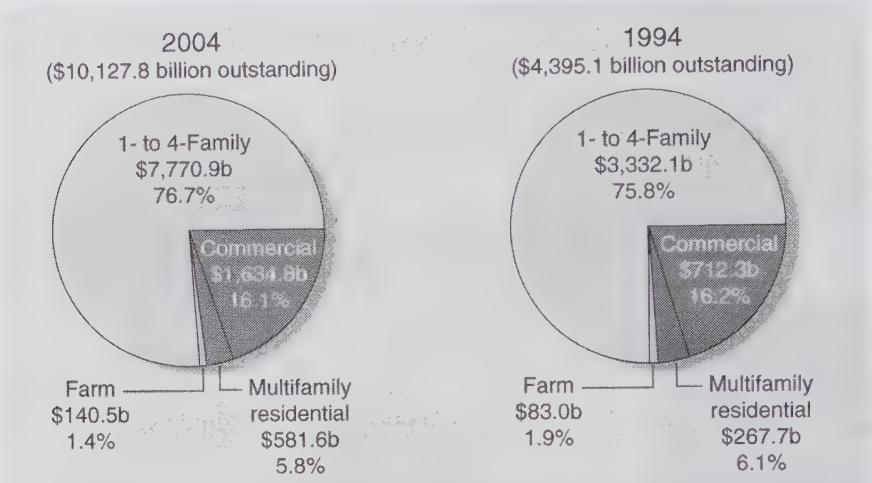
Chapter NAVIGATOR

1. What is the difference between a mortgage and a mortgage-backed security?
2. What are the main types of mortgages issued by financial institutions?
3. What are the major characteristics of a mortgage?
4. How is a mortgage amortization schedule determined?
5. What are some of the new innovations in mortgage financing?
6. What is a mortgage sale?
7. What is a pass-through security?
8. What is a collateralized mortgage obligation?
9. Who are the major mortgage holders in the United States?
10. What are the trends in the international securitization of mortgages?

MORTGAGES AND MORTGAGE-BACKED SECURITIES: CHAPTER OVERVIEW

Mortgages are loans to individuals or businesses to purchase a home, land, or other real property. As of September 2004, there were $10.13 trillion of primary mortgages outstanding, held by various financial institutions such as banks and mortgage companies. Figure 7–1 lists the major categories of mortgages and the amount of each outstanding in 1994 and 2004. Home mortgages (one to four families) are the largest loan category (76.7 percent of all mortgages in 2004), followed by commercial mortgages (used to finance specific projects that are pledged as collateral for the mortgage—16.1 percent), multifamily dwellings (5.8 percent), and farms (1.4 percent).

FIGURE 7–1 Mortgage Loans Outstanding



Source: Federal Reserve Board Web site, "Flow of Fund Accounts," March 1995 and December 2004. **www.federalreserve.gov**

Many mortgages, particularly residential mortgages, are subsequently **securitized** by the mortgage holder—they are packaged and sold as assets backing a publicly traded or privately held debt instrument. Securitization allows financial institutions' (FIs') asset portfolios to become more liquid, reduces interest rate risk and credit risk, provides FIs with a source of fee income, and helps reduce the effects of regulatory constraints such as capital requirements, reserve requirements, and deposit insurance premiums on FI profits (see Chapter 13). Currently, approximately 60 percent of home mortgages are securitized.

mortgages
Loans to individuals or businesses to purchase a home, land, or other real property.

securitized
Securities are packaged and sold as assets backing a publicly traded or privately held debt instrument.

We examine mortgage markets separately from bond and stock markets for several reasons. First, mortgages are backed by a specific piece of real property. If the borrower defaults on a mortgage, the financial institution can take ownership of the property. Only mortgage bonds are backed by a specific piece of property that allows the lender to take ownership in the event of a default. All other corporate bonds and stock give the holder a general claim to a borrower's assets. Second, there is no set size or denomination for primary mortgages. Rather, the size of each mortgage depends on the borrower's needs and ability to repay. Bonds generally have a denomination of $1,000 or a multiple of $1,000 per bond and shares of stock are generally issued in (par value) denominations of $1 per share. Third, primary mortgages generally involve a single investor (e.g., a bank or mortgage company). Bond and stock issues, on the other hand, are generally held by many (sometimes thousands of) investors. Finally, because primary mortgage borrowers are often individuals, information on these borrowers is less extensive and unaudited. Bonds and stocks are issued by publicly traded corporations that are subject to extensive rules and regulations regarding information availability and reliability.

In this chapter, we look at the characteristics and operations of the mortgage and mortgage-backed securities markets. We look at different types of mortgages and the determination of mortgage payments. (We look at the processes used by financial institutions to evaluate mortgage loan applicants in Chapter 20.) We also discuss the agencies owned or sponsored by the U.S. government that help securitize mortgage pools. We briefly describe the major forms of mortgage-backed securities and discuss the process of securitization. More complete details of the securitization process are provided in Chapter 24. We conclude the chapter with a look at international investors in mortgages and mortgage-backed securities markets, as well as trends in international securitization of mortgage assets.

PRIMARY MORTGAGE MARKET

Four basic categories of mortgages are issued by financial institutions: home, multifamily dwelling, commercial, and farm. Home mortgages ($7,770.9 billion outstanding in 2004) are used to purchase one- to four-family dwellings. Multifamily dwelling mortgages ($581.6 billion outstanding) are used to finance the purchase of apartment complexes, townhouses, and condominiums. Commercial mortgages ($1,634.8 billion outstanding) are used to finance the purchase of real estate for business purposes (e.g., office buildings, shopping malls). Farm mortgages ($140.5 billion outstanding) are used to finance the purchase of farms. As seen in Figure 7–1, while all four areas have experienced tremendous growth, the historically low mortgage rates in the 1990s and early 2000s have particularly spurred growth in the single family home area (133 percent growth from 1994 through 2004), commercial business mortgages (130 percent growth), and multifamily residential mortgages (117 percent growth).

Mortgage Characteristics

As mentioned above, mortgages are unique as capital market instruments because the characteristics (such as size, fees, interest rate) of each mortgage held by a financial institution can differ. A mortgage contract between a financial institution and a borrower must specify all of the characteristics of the mortgage agreement.

When a financial institution receives a mortgage application, it must determine whether the applicant qualifies for a loan. (We describe this process in Chapter 20.) Because most financial institutions sell or securitize their mortgage loans in the secondary mortgage market (discussed below), the guidelines set by the secondary market buyer for acceptability, as well as the guidelines set by the financial institution, are used to determine whether or not a mortgage borrower is qualified. Further, the characteristics of loans to be securitized will generally be more standardized than those that are not to be securitized. When mortgages are not securitized, the financial institution can be more flexible with the acceptance/rejection guidelines it uses and mortgage characteristics will be more varied.

lien

A public record attached to the title of the property that gives the financial institution the right to sell the property if the mortgage borrower defaults.

Collateral. As mentioned in the introduction, all mortgage loans are backed by a specific piece of property that serves as collateral to the mortgage loan. As part of the mortgage agreement, the financial institution will place a **lien** against a property that remains in place until the loan is fully paid off. A lien is a public record attached to the title of the property that gives the financial institution the right to sell the property if the mortgage borrower defaults or falls into arrears on his or her payments. The mortgage is secured by the lien—that is, until the loan is paid off, no one can buy the property and obtain clear title to it. If someone tries to purchase the property, the financial institution can file notice of the lien at the public recorder's office to stop the transaction.

down payment

A portion of the purchase price of the property a financial institution requires the mortgage borrower to pay up front.

Down Payment. As part of any mortgage agreement, a financial institution requires the mortgage borrower to pay a portion of the purchase price of the property (a **down payment**) at the closing (the day the mortgage is issued). The balance of the purchase price is the face value of the mortgage (or the loan proceeds).

Down payments decrease the probability that the borrower will default on the mortgage. A mortgage borrower who makes a large down payment is less likely to walk away from the house should property values fall, leaving the mortgage unpaid. As seen in the In the News box, the drop in real estate values in Texas in the 1980s caused many mortgage borrowers to walk away from their homes and mortgages, as well as many mortgage lenders to fail.

The size of the down payment depends on the financial situation of the borrower. Generally, a 20 percent down payment is required (i.e., the loan-to-value ratio may be no more than 80 percent). Borrowers that put up less than 20 percent are required

DO YOU UNDERSTAND?

1. The condition of savings and loans associations in Texas in the [illegible]
2. [illegible]

IN THE NEWS

Texas S&L Toll: 80% Likely to Need Aid

The Texas thrift crisis, which has already claimed 87 of the state's savings institutions, has not hit rock bottom yet. Amid rising interest rates and a continuing drop in real estate values comes this sobering prediction: Only one out of five savings and loan associations is expected to survive without federal assistance. "The crisis is worsening at an accelerated pace," said Stuart Chesley, chairman of the Texas Savings and Loan League. "We are unable to contain the losses."

The ailing Federal Savings and Loan Insurance Corp. spent $24.5 billion last year to rescue 87 Texas S&Ls, or about one-third of the state total. But at least 70 more are insolvent and still in need of assistance. And an additional 68 Texas thrifts are in danger of failing, according to a study prepared by Ferguson & Co. for the Texas Savings and Loan League. That would leave 54 survivors, or 19 percent of the 279 savings associations that were operating in Texas last March.

For many Texas thrift executives, the crisis will bring an end to their institutions and their careers. Dozens upon dozens of managers are throwing their hands up in the face of plummeting real estate values and loan demand. For the national thrift industry, the Texas crisis paints a picture of what could happen in other overbuilt markets. "To a lesser extent, what we are seeing in Texas probably will be repeated elsewhere," said consultant William Ferguson, principal of Ferguson & Co., Irving, Tex.

Collapsing real estate loans and property values are at the heart of the Texas crisis. The twin evils are symptoms of a vastly overbuilt market. The poor performance of the expected survivors—arguably the most conservative lenders—illustrates the troubles of the overall industry. The state's 54 strongest thrifts experienced a 45 percent increase in repossessed assets during the nine months ended Sept. 30, according to Ferguson & Co.

Losses at these thrifts—largely spurred by loan-loss provisions and write-downs—equaled 53 percent of the group's total profits from the previous two years. Retained earnings for the group fell by 24 percent. "We still are seeing significant devaluations in Texas real estate," said James Pledger, Texas savings and loan commissioner. "The depth of the economic hole in this state is hard to comprehend." Damage from the real estate implosion promises to keep regulators on the defensive. Up to 138 more Texas thrifts with combined assets of about $40 billion may need federal assistance before the Texas crisis has run its course.

www.americanbanker.com

Source: *The American Banker*, February 15, 1989 p.1, by Steve Klinkerman.

private mortgage insurance

insurance contract purchased by a mortgage borrower guaranteeing to pay the financial institution the difference between the value of the property and the balance remaining on the mortgage.

to purchase **private mortgage insurance** (PMI). (Technically, the insurance is purchased by the lender (the financial institution) but paid for by the borrower, generally as part of the monthly payment.) In the event of default, the PMI issuer (such as Norwest Mortgage Company) guarantees to pay the financial institution the difference between the value of the property and the balance remaining on the mortgage. As payments are made on the mortgage, or if the value of the property increases, a mortgage borrower can eventually request that the PMI requirement be removed. Every financial institution differs in its requirements for removing the PMI payment from a mortgage. However, in most cases financial institutions require a waiting period of one to two years after the loan's origination date, proof through an approved appraiser that the loan-to-value ratio is less than 80 percent, on-time payments during the waiting period, and a letter from the borrower requesting that the PMI be removed from the loan.

federally insured mortgages

Mortgages originated by financial institutions, with repayment guaranteed by either the Federal Housing Administration (FHA) or the Veterans Administration (VA).

Insured versus Conventional Mortgages. Mortgages are classified as either federally insured or conventional. **Federally insured mortgages** are originated by financial institutions, but repayment is guaranteed (for a fee of 0.5 percent of the loan amount) by either the Federal Housing Administration (FHA) or the Veterans Administration (VA). In order to qualify, FHA and VA mortgage loan applicants must meet specific requirements set by these government agencies (e.g., VA-insured loans are available only to individuals who served and were honorably discharged from military service in the United States). Further, the maximum size of the mortgage is limited (the limit varies by state and is based on the

cost of housing). For example, in 2005, FHA loan limits on single-family homes ranged from $160,176 to $290,319, depending on location and cost of living. FHA or VA mortgages require either a very low or zero down payment. (FHA mortgages require as little as a 3 percent down payment.)

conventional mortgages
Mortgages issued by financial institutions that are not federally insured.

Conventional mortgages are mortgages held by financial institutions and are not federally insured (but as already discussed, they generally are required to be privately insured if the borrower's down payment is less than 20 percent of the property's value). Secondary market mortgage buyers will not generally purchase conventional mortgages that are not privately insured and that have a loan-to-value ratio of greater than 80 percent.

Mortgage Maturities. A mortgage generally has an original maturity of either 15 or 30 years. Until recently, the 30-year mortgage was the one most frequently used. However, the 15-year mortgage has grown in popularity. Mortgage borrowers are attracted to the 15-year mortgage because of the potential saving in total interest paid (see below). However, because the mortgage is paid off in half the time, monthly mortgage payments are higher on a 15-year than on a 30-year mortgage.

Financial institutions find the 15-year mortgage attractive because of the lower degree of interest rate risk on a 15-year relative to a 30-year mortgage. To attract mortgage borrowers to the 15-year maturity mortgage, financial institutions generally charge a lower interest rate on a 15-year mortgage than a 30-year mortgage.

Most mortgages allow the borrower to prepay all or part of the mortgage principal early without penalty. In general, the monthly payment is set at a fixed level to repay interest and principal on the mortgage by the maturity date (i.e., the mortgage is fully **amortized**). We illustrate this payment pattern for a 15-year fixed-rate mortgage in Figure 7–2. However, other mortgages have interest rates and thus payments that vary.

amortized
A mortgage is amortized when the fixed principal and interest payments fully pay off the mortgage by its maturity date.

In addition to 15- and 30-year fixed-rate and variable-rate mortgages, financial institutions sometimes offer **balloon payment mortgages.** A balloon payment mortgage requires a fixed monthly interest payment (and, sometimes, principal payments) for a three-to-five year period. Full payment of the mortgage principal (the balloon payment) is then required at the end of the period, as illustrated for a five-year balloon payment mortgage in Figure 7–2. Because they normally consist of interest only, the monthly payments prior to maturity are lower than those on an amortized loan (i.e., a loan that requires periodic repayments of principal and interest). Generally, because few borrowers save enough funds to pay off the mortgage in three to five years, the mortgage principal is refinanced at the

balloon payment mortgage
Mortgage that requires a fixed monthly interest payment for a three- to five-year period. Full payment of the mortgage principal (the balloon payment) is then required at the end of the period.

FIGURE 7–2 Fixed-Rate versus Balloon Payment Mortgage

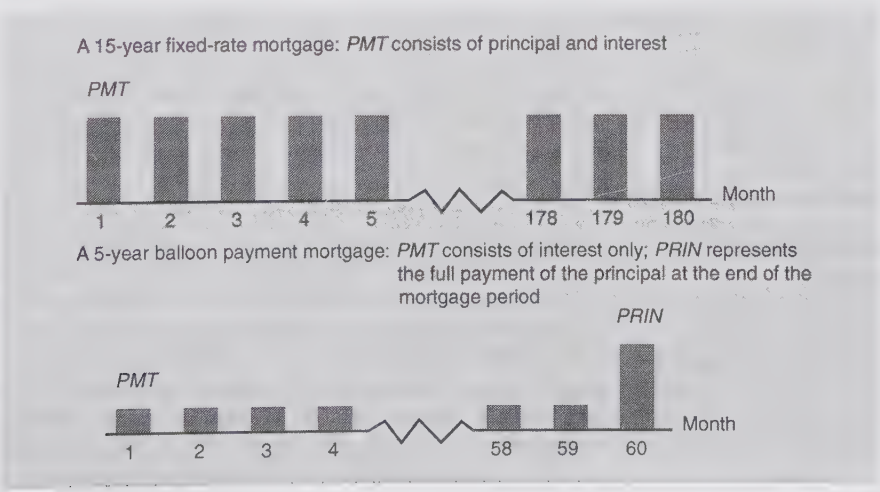
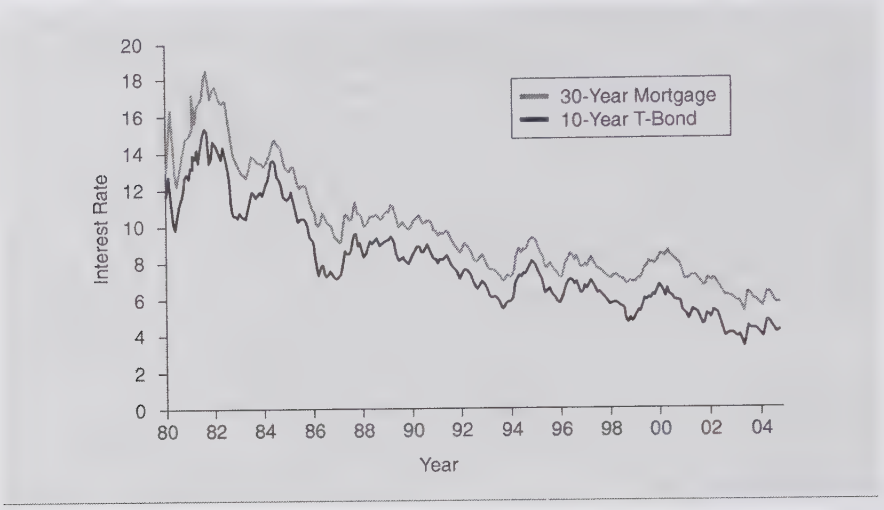


FIGURE 7–3 30-Year Mortgage versus 10-Year Treasury Rates



Source: Federal Reserve Board Web site, "Research and Data," December 2004. **www.federalreserve.gov**

current mortgage interest rate at the end of the balloon loan period (refinancing at maturity is not, however, guaranteed). Thus, with a balloon mortgage the financial institution essentially provides a long-term mortgage in which it can periodically revise the mortgage's characteristics.

Interest Rates. Possibly the most important characteristic identified in a mortgage contract is the interest rate on the mortgage. Mortgage borrowers often decide how much to borrow and from whom solely by looking at the quoted mortgage rates of several financial institutions. In turn, financial institutions base their quoted mortgage rates on several factors. First, they use the market rate at which they obtain funds (e.g., the fed funds rate or the rate on certificates of deposit). The market rate on available funds is the base rate used to determine mortgage rates. Figure 7–3 illustrates the trend in mortgage interest rates and 10-year Treasury bond rates from 1980 through 2004. The rate on a specific mortgage is also adjusted for other factors (e.g., whether the mortgage specifies a fixed or variable (adjustable) rate of interest and whether the loan specifies discount points and other fees)—see below.

fixed-rate mortgage

A mortgage that locks in the borrower's interest rate and thus the required monthly payment over the life of the mortgage, regardless of how market rates change.

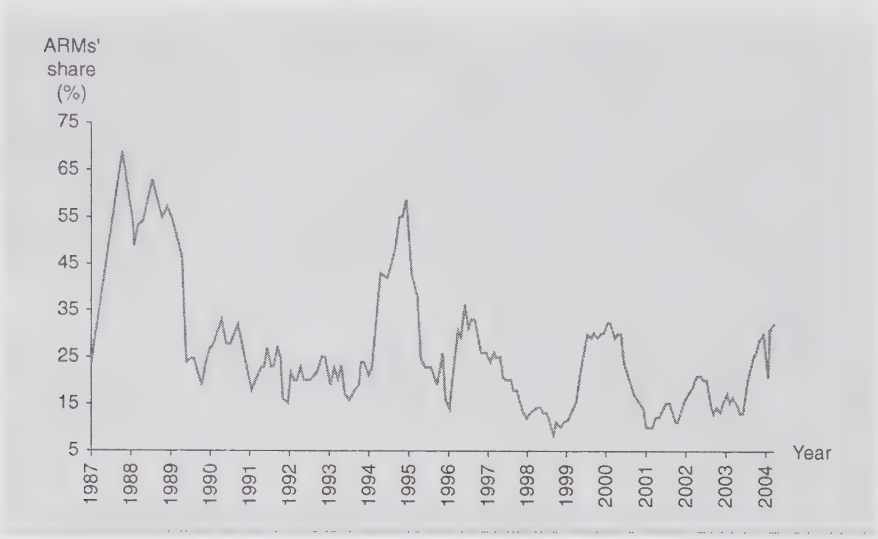
adjustable-rate mortgage

A Mortgage in which the interest rate is tied to some market interest rate. Thus, the required monthly payments can change over the life of the mortgage.

Fixed- versus Adjustable-Rate Mortgages. Mortgage contracts specify whether a fixed or variable rate of interest will be paid by the borrower. A **fixed-rate mortgage** locks in the borrower's interest rate and thus required monthly payments over the life of the mortgage, regardless of how market rates change. In contrast, the interest rate on an **adjustable-rate mortgage** (ARM) is tied to some market interest rate or interest rate index. Thus, the required monthly payments can change over the life of the mortgage. ARMs generally limit the change in the interest rate allowed each year and during the life of the mortgage (called *caps*). For example, an ARM might adjust the interest rate based on the average Treasury bill rate plus 1.5 percent, with caps of 1.5 percent per year and 4 percent over the life of the mortgage.

Figure 7–4 shows the percentage of ARMs relative to all mortgages closed from 1987 through 2004. Mortgage borrowers generally prefer fixed-rate loans to ARMs, particularly when interest rates in the economy are low. If interest rates rise, ARMs may cause borrowers to be unable to meet the promised payments on the mortgage. In contrast, most mortgage lenders prefer ARMs. When interest rates rise, ARM payments on their mortgage assets will rise. Since deposit rates and other liability rates too will be rising, it will be easier for financial institutions to pay the higher interest rates to their depositors when they

FIGURE 7–4 ARMs' Share of Total Loans Closed, 1987–2004



Source: Federal Housing Finance Board Web site, December 2004. **www.fhfb.gov**

issue ARMs. However, higher interest payments mean mortgage borrowers may have trouble making their payments. Thus, default risk increases. As a result, while ARMs reduce a financial institution's interest rate risk, they also increase their default risk.

Note from Figure 7–4 the behavior of the share of ARMs to fixed-rate mortgages over two recent periods—1997 to 1999 and late 2000 through spring 2004—when interest rates fell dramatically. Notice that borrowers' preferences for fixed-rate mortgages prevailed over these two periods, as a consistently low percentage of total mortgages closed were ARMs (over these periods the percentage of ARMs to total mortgages issued averaged only 17 percent and 14 percent, respectively).

discount points

Interest payments made when the loan is issued (at closing). One discount point paid up front is equal to 1 percent of the principal value of the mortgage.

Discount Points. **Discount points** (or more often just called points) are fees or payments made when a mortgage loan is issued (at closing). One discount point paid up front is equal to 1 percent of the principal value of the mortgage. For example, if the borrower pays 2 points up front on a $100,000 mortgage, he or she must pay $2,000 at the closing of the mortgage. While the mortgage principal is $100,000, the borrower effectively has received $98,000. In exchange for points paid up front, the financial institution reduces the interest rate used to determine the monthly payments on the mortgage. The borrower determines whether the reduced interest payments over the life of the loan outweigh the up-front fee through points. This decision depends on the period of time the borrower expects to hold the mortgage (see below).

Other Fees. In addition to interest, mortgage contracts generally require the borrower to pay an assortment of fees to cover the mortgage issuer's costs of processing the mortgage. These include such items as costs of:

Application fee. Covers the issuer's initial costs of processing the mortgage application and obtaining a credit report.

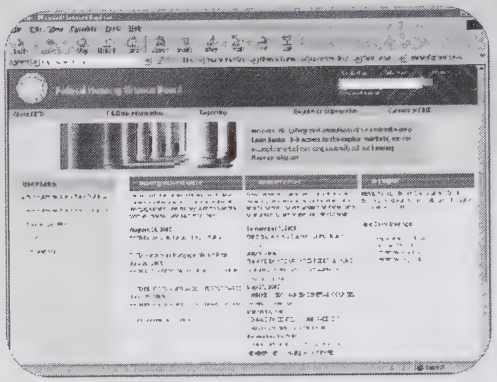
Title search. Confirms the borrower's legal ownership of the mortgaged property and ensures there are no outstanding claims against the property.

Title insurance. Protects the lender against an error in the title search.

Appraisal fee. Covers the cost of an independent appraisal of the value of the mortgaged property.

SEARCH THE SITE

Go to the Federal Housing Finance Board's Web site and find the latest information available on the percentage of mortgages issued as adjustable- and fixed-rate mortgages.



Go to the Federal Housing Finance Board Web site at **www.fhfb.gov.**

Under "Monthly Interest Rate" click on "View Summary Tables"

Click on "—By Property Type"

This will download an EXCEL file on to your computer that will contain data on fixed- versus adjustable-rate mortgage originations.

Questions

1. Calculate the most recent percentage of mortgages issued as adjustable rate mortgages.
2. What has happened to interest rates since 2004 to cause this percentage to change from that in Figure 7–4?

Loan origination fee. Covers the remaining costs to the mortgage issuer for processing the mortgage application and completing the loan.

Closing agent and review fees. Cover the costs of the closing agent who actually closes the mortgage.

Other costs. Any other fees, such as VA loan guarantees, FHA or private mortgage insurance.

Figure 7–5 presents a sample closing statement in which the various fees are reported and the payment required by the borrower at closing is determined.

Mortgage Refinancing. Mortgage refinancing occurs when a mortgage borrower takes out a new mortgage and uses the proceeds obtained to pay off the current mortgage. Mortgage refinancing involves many of the same details and steps involved in applying for a new mortgage and can involve many of the same fees and expenses. Mortgages are most often refinanced when a current mortgage has an interest rate that is higher than the current interest rate. As coupon rates on new mortgages fall, the incentive for mortgage borrowers to pay off old, high coupon rate mortgages and refinance at lower rates increases. Figure 7–6 shows the percentage of mortgage originations that involved refinancings from 1990 through 2004. Notice that as mortgage rates fall (see Figure 7–3) the percentage of mortgages that are refinancings increases. For example, as mortgage rates fell in the early 2000s, refinancings increased to over 70 percent of all mortgages originated.

By refinancing the mortgage at a lower interest rate, the borrower pays less each month—even if the new mortgage is for the same amount as the current mortgage. Traditionally, the decision to refinance involves balancing the savings of a lower monthly payment against the costs (fees) of refinancing. However, refinancing adds transaction and recontracting costs. Origination costs or points for new mortgages, along with the cost of appraisals and credit checks, frequently arise as well. An often-cited rule of thumb is that the interest rate for a new mortgage should be 2 percentage points below the rate on the current mortgage for refinancing to make financial sense.

FIGURE 7–5 Mortgage Closing Statement

Borrower(s): Manuel Goodperson, Manuela Goodperson — Date: 02/05/2007
Lender: Starpointe Savings Bank Peasant Run Plaza Warre
Property: 321 Main St. Watchung, NJ 07060

Type of Mortgage FHA ( ) GI ( ) Convent. ( )			Amount of Loan	$106,400.00
Additional Funds made available by: $				
			Total A	$106,400.00
PAYMENTS to Lender (to establish escrow reserve)				
Taxes	3 months @	$ 172.50	$ 517.50	
Insurance	3 months @	$ 28.92	$ 86.76	
Mortgage Insurance Premium	2 months @	$ 69.16	$ 138.32	
0.00			$	
0.00			$	
Flood Ins.			$ 44.08	
		Total B	$ 786.66	
OTHER PAYMENTS to Lender				
Application Fee			$ 54.00	
Appraisal Fee			$ 500.00	
Credit Report Fee			$	
Mortgage Origination Fee			$ 564.00	
Points Paid by the Seller(s)			$	
Processing Fee			$	
Interest on Loan to			$ 629.66	
			$	
			$	
			$	
		Total C	$ 1,747.66	
PAYMENTS to Others				
Current Taxes & Assessments			$	
Title Search & Examination			$	
Survey			$ 415.00	
Title Insurance Policies			$ 932.00	
Hazard Insurance			$	
Recording Fees			$ 8.11	
Attorney Fees			$ 750.00	
Realty Transfer Fee or Tax			$	
Broker's Commission			$	
Mortgage Cancellation Fee			$	
Pay off of Mortgage Loan(s)			$ 1,000.00	
Balance due to Seller(s)			$ 104,482.00	
			$	
			$	
			$	
		Total D	$ 107.587.11	
		Total B, C, and D		$110,121.43
Overpayment returned to Borrower (A less total B, C, and D)				$ −3,721.43

0 Year Mortgage @ % per year monthly payment payable day of each month commencing 02/05/2007

Principal & Interest	$
1/12 Taxes (Estimated)	$
1/12 Insurance	$
1/12 Mortgage Insurance Premium	$
Total	$

This statement has been examined by us and explained to our complete satisfaction. We have been given a copy of this statement. We authorize and direct that the closing attorney distribute the funds as set forth above.

Borrower Manuel Goodperson

Closing Attorney
Larry Lawyer, Esq

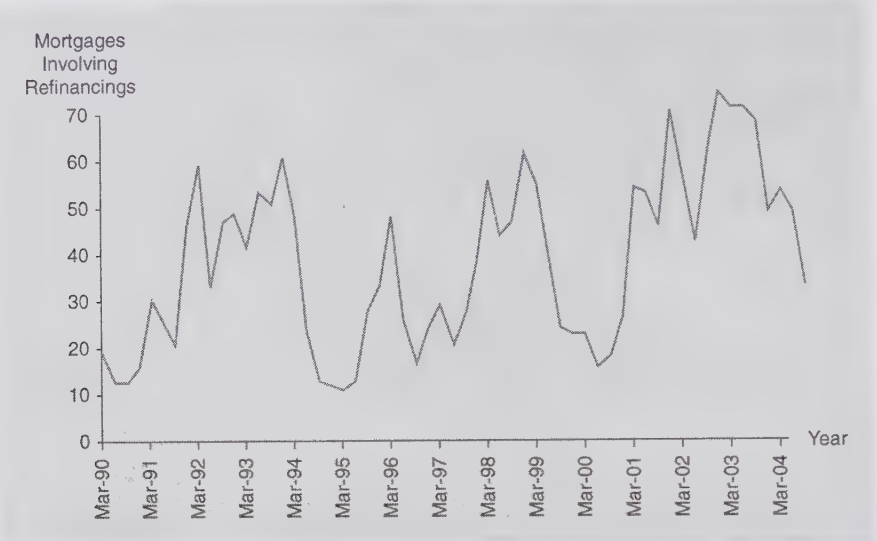
Borrower Manuela Goodperson

4 Mortgage Amortization

amortization schedule
Schedule showing how the monthly mortgage payments are split between principal and interest.

The fixed monthly payment made by a mortgage borrower generally consists partly of repayment of the principal borrowed and partly of the interest on the outstanding (remaining) balance of the mortgage. In other words, these fixed payments fully amortize (pay off) the mortgage by its maturity date. During the early years of the mortgage, most of the fixed monthly payment represents interest on the outstanding principal and a small amount represents a payoff of the outstanding principal. As the mortgage approaches maturity, most of the payment represents a payoff of the outstanding principal and a small amount represents interest. An **amortization schedule** shows how the fixed monthly payments are split between principal and interest.

FIGURE 7–6 Mortgage Refinancings as a Percentage of All Mortgages Originated, 1990–2004



Source: Mortgage Bankers Association Web site, December 2004. **www.mbaa.org**

EXAMPLE 7–1 Calculation of Monthly Mortgage Payments

You plan to purchase a house for $150,000 using a 30-year mortgage obtained from your local bank. The mortgage rate offered to you is 8 percent with zero points. In order to forgo the purchase of private mortgage insurance, you will make a down payment of 20 percent of the purchase price ($30,000 = .20 × $150,000) at closing and borrow $120,000 through the mortgage.

The monthly payments on this mortgage are calculated using the time value of money formulas presented in Chapter 2. Specifically, the amount borrowed through the mortgage represents a present value of the principal, and the monthly payments represent a monthly annuity payment. The equation used to calculate your fixed monthly mortgage payments to pay off the $120,000 mortgage at an 8 percent annual (8%/12 = .6667% monthly) interest rate over 30 years (or 30 × 12 = 360 payments) is as follows:[1]

$$PV = PMT \sum_{j=1}^{t} \left(\frac{1}{1 + r} \right)^{j}$$

$$= PMT\,(PVIFA_{r,t})$$

where

PV = Principal amount borrowed through the mortgage
PMT = Monthly mortgage payment
$PVIFA$ = Present value interest factor of an annuity
r = Monthly interest rate on the mortgage (equals the nominal annual interest rate, i, divided by 12 (months per year))
t = Number of months (payments) over the life of the mortgage

1. Mortgage valuation is very similar to bond valuation discussed in Chapter 3. Recall the formula to determine the present value of a bond:

$$V_b = INT(PVIFA_{r,t}) + M(PVIF_{r,t})$$

Both securities require periodic annuity payments of interest. However, mortgages generally require that a portion of the principal be included with each payment. With bonds, the full principal amount borrowed, M, is generally paid when the bond matures.

For the mortgage in this example:

$$\$120{,}000 = PMT(PVIFA_{.6667\%,360})$$

or:

$$PMT = \$120{,}000/(PVIFA_{.6667\%,360})$$

Therefore:

$$PMT = \$120{,}000/136.2835 = \$880.52$$

Thus, your monthly payment is $880.52.

We now construct the amortization schedule for this mortgage.

EXAMPLE 7–2 Construction of an Amortization Schedule

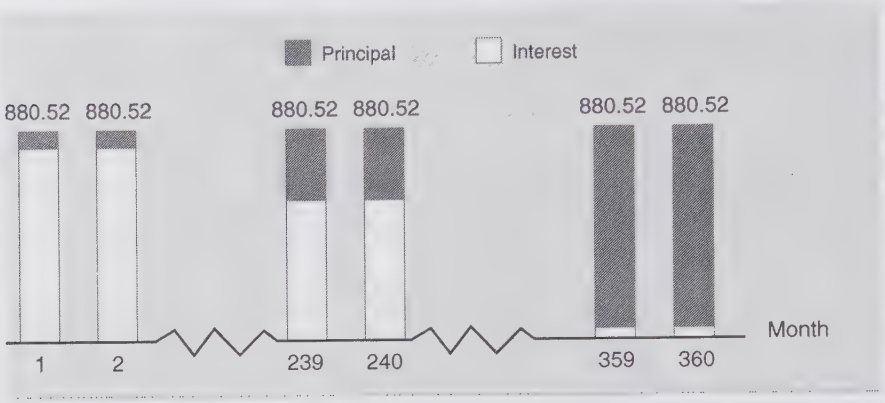
Using the monthly payment calculated on the mortgage in Example 7–1, we construct an amortization schedule in Table 7–1. Column 1 is the month in the 360-month loan period. Column 2 is the balance of the mortgage outstanding at the beginning of each month. Column 3 is the monthly payment on the mortgage, calculated in Example 7–1. Column 4, Interest, is the portion of the monthly payment that represents the pure interest payment based on the loan balance outstanding at the beginning of the month (beginning loan balance × 8%/12). Column 5, Principal, is the portion of the monthly payment that represents the repayments of the mortgage's principal (monthly payment – monthly interest, or in this example for month 1, $880.52 − $800 = $80.52). Column 6 is the balance of the mortgage principal outstanding at the end of the month. This value becomes the beginning balance in the next month.

Notice that the total payments made by the mortgage borrower over the 30-year life of the mortgage are $316,987.20. Of this amount $120,000 is repayment of the original principal. Thus, the borrower pays a total of $196,978.20 in interest over the life of the mortgage. Figure 7–7 illustrates the proportion of each payment that is interest versus principal. Notice that during the early years the majority of each payment is interest and very little goes toward the payment of principal. As the mortgage approaches maturity the majority of each payment is principal and very little goes to paying interest.

TABLE 7–1 Amortization Schedule for a 30-Year Mortgage

(1) Month	(2) Beginning Loan Balance	(3) Payment	(4) Interest	(5) Principal	(6) Ending Loan Balance
1	$120,000.00	$880.52	$800.00	$80.52	$119,919.48
2	119,919.48	880.52	799.46	81.06	119,838.42
•	•	•	•	•	•
•	•	•	•	•	•
119	105,623.54	880.52	704.16	176.36	105,447.18
120 (10 years)	105,447.18	880.52	702.98	177.54	105,269.64
•	•	•	•	•	•
•	•	•	•	•	•
239	73,359.08	880.52	489.06	391.46	72,967.62
240 (20 years)	72,967.62	880.52	486.45	394.07	72,573.55
•	•	•	•	•	•
•	•	•	•	•	•
359	1,743.58	880.52	11.63	868.89	874.69
360 (30 years)	874.69	880.52	5.83	874.69	0
Total		$316,987.20	$196,987.20	$120,000.00	

FIGURE 7–7 Amortization of a 30-Year Mortgage



As discussed above, an advantage of a 15-year mortgage to a mortgage borrower is that the total interest paid on a 15-year mortgage is smaller than that paid on a 30-year mortgage.

EXAMPLE 7–3 Comparison of Interest Paid on a 15-Year versus a 30-Year Mortgage

Using the information in Example 7–1 but changing the loan maturity to 15 years (180 months), the monthly payment on the $120,000 mortgage loan is:

$$\$120{,}000 = PMT(PVIFA_{.6667\%,180})$$

or:

$$PMT = \$120{,}000/(PVIFA_{.6667\%,180})$$

Therefore:

$$PMT = \$120{,}000/104.6406 = \$1{,}146.78$$

Solving for *PMT*, your monthly mortgage payment is $1,146.78. Table 7–2 shows the corresponding loan amortization schedule.

Total payments on the 15-year mortgage are $206,420.85, of which $86,420.85 is interest. This compares to interest of $196,978.20 on the 30-year mortgage (a difference of $110,557.35). The mortgage borrower's interest payments are reduced significantly with the 15-year mortgage relative to the 30-year mortgage. However, the borrower must pay $1,146.78 per month with the 15-year mortgage compared to $880.52 with the 30-year mortgage, a difference of $266.26 per month. This may be difficult if his or her income level is not very high.

Another factor that affects the amortization of a loan is whether the borrower pays discount points up front in exchange for a reduced interest rate and, consequently, reduced monthly payments.

TABLE 7-2 Amortization Schedule for a 15-Year Mortgage

Year	Beginning Loan Balance	Payment	Interest	Principal	Ending Loan Balance
1	$120,000.00	$1,146.78	$800.00	$ 346.78	$119,653.22
2	119,653.22	1,146.78	797.69	349.09	119,304.13
•	•	•	•	•	•
•	•	•	•	•	•
59	95,542.57	1,146.78	636.95	509.83	95,032.74
60 (5 years)	95,032.74	1,146.78	633.55	513.23	94,519.51
•	•	•	•	•	•
•	•	•	•	•	•
199	58,081.72	1,146.78	387.21	759.57	57,322.15
120 (10 years)	57,322.15	1,146.78	382.15	764.63	56,557.52
•	•	•	•	•	•
•	•	•	•	•	•
179	2,270.83	1,146.78	15.14	1,131.64	1,139.19
180 (15 years)	1,139.19	1,146.78	7.59	1,139.19	0
Total		$206,420.85	$86,420.85	$120,000.00	

EXAMPLE 7-4 Analyzing the Choice between Points and Monthly Payments of Interest

You plan to purchase a house for $150,000 using a 30-year mortgage obtained from your local bank. You will make a down payment of 20 percent of the purchase price, in this case, equal to $30,000. Thus, the mortgage loan amount will be $120,000. Your bank offers you the following two options for payment:

Option 1: Mortgage rate of 8 percent (or 8%/12 = .6667% per month) and zero points.
Option 2: Mortgage rate of 7.75 percent (or 7.75%/12 = .6458% per month) and 2 points ($2,400 = $120,000 × .02).

If option 2 is chosen, you receive $117,600 at closing ($120,000 − $2,400), although the mortgage principal is $120,000.

To determine the best option, we first calculate the monthly payments for both options as follows:

Option 1: $120,000 = $PMT\ (PVIFA_{.6667\%,360}) \rightarrow PMT = \$880.52$
Option 2: $120,000 = $PMT\ (PVIFA_{.6458\%,360}) \rightarrow PMT = \$859.69$

In exchange for $2,400 up front, option 2 reduces your monthly mortgage payments by $20.83. The present value of these savings (evaluated at 7.75 percent) over the 30 years is:

$$PV = \$20.83\ (PVIFA_{.6458\%,360}) = \$2,907.54$$

Option 2 is the better choice. The present value of the monthly savings, $2,907.54, is greater than the points paid up front, $2,400.

Suppose, however, you plan on paying off the loan in 15 years (180 months) even though the mortgage has a 30-year maturity. Now the monthly savings from option 2 have a present value of:

$$PV = \$20.83\ (PVIFA_{.6458\%,180}) = \$2,212.95$$

Option 1 becomes the better deal. The present value of the monthly savings, $2,212.95, is less than the points paid up front, $2,400.

To find the point (number of years) at which you are indifferent between the two options, you solve the following equation:

$$\$2{,}400 = \$20.83\ (PVIF_{.6458\%,\ X})$$

Solving for X gives 211 months, or 17.6 years. Thus, if you plan on paying off the mortgage in 17.6 years or less, option 1 is the better deal. If you plan on paying off the mortgage in more than 17.6 years, option 2 is preferred.

automatic rate-reduction mortgages

Mortgages in which the lender automatically lowers the rate on an existing mortgage when prevailing rates fall.

Notice that the choice of points (and lower monthly payments) versus no points (and higher monthly payments) depends on how long the mortgage borrower takes to pay off the mortgage. Specifically, the longer the borrower takes to pay off the mortgage, the more likely he or she is to choose points and a lower mortgage rate. Thus, by offering points, the mortgage lender decreases the probability that the mortgage borrower will prepay the mortgage—paying the mortgage off early reduces the present value of the monthly savings to the mortgage borrower.

Other Types of Mortgages

5

New methods of creative financing have been developed by financial institutions to attract mortgage borrowers. These include automatic rate-reduction mortgages, graduated-payment mortgages, growing-equity mortgages, second mortgages, shared-appreciation mortgages, equity-participation mortgages, and reverse-annuity mortgages.

graduated-payment mortgages

Mortgages in which borrowers make small payments early in the life of the mortgage. Payments then increase over the first 5 to 10 years, and finally payments level off at the end of the mortgage period.

growing-equity mortgages

Mortgages in which the initial payments are the same as on a conventional mortgage, but they increase over a portion or the entire life of the mortgage. In contrast to GPMs, which do not affect the time until the mortgage is paid off, the incremental increase in monthly payments on GEMs reduces the principal on the mortgage more quickly. This reduces the actual life of the mortgage.

Automatic Rate-Reduction Mortgages. As the name suggests, with automatic rate-reduction mortgages, the lender automatically lowers the rate on an existing mortgage when prevailing rates fall. Unlike variable-rate mortgages, while the interest rate on an automatic rate-reduction mortgage can be adjusted downward, it will not be increased if prevailing rates increase. Thus, interest rates on automatic rate-reduction mortgages can only fall. Mortgage lenders offer automatic rate-reduction mortgages as a way of keeping their mortgage customers from refinancing their mortgages with another mortgage lender when mortgage rates fall.

Graduated-Payment Mortgages. **Graduated-payment mortgages** (GPMs) allow mortgage borrowers to make small payments early in the life of the mortgage. The payments then increase over the first 5 to 10 years, and finally payments level off at the end of the mortgage period. GPMs are used by households that expect their incomes to rise along with the GPM payment. GPMs are also used by homeowners who plan to move or refinance quickly. They allow borrowers to qualify for a larger loan than they could get with a conventional mortgage. The risk to the borrower and the financial institution is that, if the expected income increase does not occur, the borrower may default on the mortgage. GPMs are not an extremely common type of mortgage, but some financial institutions (such as Allied Home Mortgage) that do significant business in this area have a separate Web site to provide information on their GPMs.

Growing-Equity Mortgages. **Growing-equity mortgages** (GEMs) are mortgages in which the initial payments are the same as on a conventional mortgage, but they increase over a portion or the entire life of the mortgage. In contrast to GPMs, which do not affect the time until the mortgage is paid off, the incremental increase in monthly payments on GEMs reduces the principal on the mortgage more quickly. This reduces the actual life of the mortgage. Thus, GEMs are used by borrowers who want to pay off a mortgage in a shorter period of time than stated in the mortgage contract and, like GPMs, borrowers who expect their incomes to rise over the life of the mortgage. Although GEMs represent only a small part of the mortgage loan market, the reduced term and faster repayment of the

mortgage principal make GEMs more attractive to lenders than a standard fixed-rate loan. Like GPMs default occurs on the mortgage if the borrower misses a payment.

second mortgages
Loans secured by a piece of real estate already used to secure a first mortgage.

home equity loan
Loans that let customers borrow on a line of credit secured with a second mortgage on their homes.

shared-appreciation mortgage
Allows a home buyer to obtain a mortgage at an interest rate below current market rates in exchange for a share in any appreciation in the property value. If the property is eventually sold for more than the original purchase price, the financial institution is entitled to a portion of the gain.

equity-participation mortgage
A mortgage that is similar to a SAM except that an outside investor shares in the appreciation of the property rather than the financial institution.

reverse-annuity mortgage
A mortgage for which a mortgage borrower receives regular monthly payments from a financial institution rather than making them. When the RAM matures (or the borrower dies) the borrower (or the estate of the borrower) sells the property to retire the debt.

Second Mortgages. **Second mortgages** are loans secured by a piece of real estate already used to secure a first mortgage. Should a default occur, the second mortgage holder is paid only after the first mortgage is paid off. As a result, interest rates on second mortgages are higher than on first mortgages.

About 15 percent of all primary mortgage holders also have second mortgages. Second mortgages provide mortgage borrowers with a way to use the equity they have built up in their homes as collateral on another mortgage, thus allowing mortgage borrowers to raise funds without having to sell their homes. Financial institutions often offer **home equity loans** that let customers borrow on a line of credit secured with a second mortgage on their homes. The dollar value of home equity loans issued by U.S. depository institutions and outstanding in September 2004 was $459.8 billion, compared to a total of $2,242.5 billion in total home mortgage loans. Further, the rate of interest financial institutions charged on home equity loans was 7.06 percent compared to 5.42 percent on 15-year fixed-rate first mortgage loans.

Interest on all mortgages (first, second, and home equity) secured by residential real estate is tax deductible. Interest on other types of individual loans—such as consumer loans—is not eligible for a tax deduction.

Shared-Appreciation Mortgages. Introduced in the early 1980s, a **shared-appreciation mortgage** (SAM) allows a home buyer to obtain a mortgage at an interest rate below current market rates (as much as 2 percent) in exchange for a share (given to the lender) in any appreciation in the property value. Thus, the borrower's monthly mortgage payments are smaller. However, if the property is eventually sold for more than the original purchase price, the financial institution is entitled to a portion of the gain. The financial institution has bought, in effect, a call option on the value of the house compared to its purchase price (with the house buyer being viewed as the seller of that option). SAMs are used mainly when interest rates are high because they allow borrowers who would not qualify for high interest rate (high monthly payment) mortgages to do so. Although SAM originations have been small, financial institutions that issue SAMs experience about half the interest rate risk on SAMs compared to conventional fixed-rate mortgages.

Equity-Participation Mortgages. An **equity-participation mortgage** (EPM) is similar to a SAM except that an outside investor shares in the appreciation of the property rather than the financial institution that issues the mortgage. The investor either provides a portion of the down payment on the property or provides monthly payments. While not used much in the early 2000s when interest rates were low, EPMs were very popular in the 1980s when interest rates peaked. EPMs allowed otherwise nonqualifying homeowners to obtain a mortgage.

Reverse-Annuity Mortgages. With a **reverse-annuity mortgage** (RAM), a mortgage borrower receives regular monthly payments from a financial institution rather than making them. When the RAM matures (or the borrower dies), the borrower (or the borrower's estate) sells the property to retire the debt. RAMs were designed as a way for retired people to live on the equity they have built up in their homes without the necessity of selling the homes. Maturities on RAMs are generally set such that the borrower will likely die prior to maturity.

As the U.S. population ages, RAMs are growing in popularity. Because so many people retire asset rich and income poor, RAMs present a way for seniors to unlock some of the value tied up in their home to boost their income. Funds received from a RAM may be used for any purpose including meeting housing expenses (such as taxes, insurance, and maintenance expenses), as well as other living expenses. RAMs provide a way for retired homeowners to maintain financial independence as well as ownership of their home, but

DO YOU UNDERSTAND?

they are more costly than more conventional types of mortgages. Thus, RAMs are attractive mainly to older homeowners who have accumulated substantial equity in their homes.

SECONDARY MORTGAGE MARKETS

After financial institutions originate mortgages, they often sell or securitize them in the secondary mortgage market. In 2004, over 60 percent of all residential mortgages were securitized in this fashion. The sale/securitization of mortgages in the secondary mortgage markets reduces the liquidity risk, interest rate risk, and credit risk experienced by the originating financial institution compared to keeping the mortgage in its asset portfolio. For example, depository institutions obtain the majority of their funds from short-term deposits. Holding long-term fixed-rate mortgages in their asset portfolios subjects them to interest rate risk, particularly if interest rates are expected to increase (see Chapter 22). Moreover, selling/securitizing mortgages can generate fee income for the mortgage-originating financial institution and helps reduce the effects of regulatory constraints (see Chapter 13). In this section, we introduce and provide an overview of the secondary mortgage markets. We look at these markets in more detail, including how financial institutions can use these markets to hedge credit risk on their balance sheets in Chapter 24.

Many financial institutions such as mortgage companies prefer to concentrate on the servicing of mortgages rather than the long-term financing of them, which occurs if they are kept on the balance sheet. For example, in the second quarter of 2004 New Century Financial Corp., one of the largest mortgage finance companies, originated $12.3 billion of mortgages and sold $10.3 billion of them in the secondary mortgage markets. The loan originator may also act as a servicer, collecting payments from mortgage borrowers and passing the required interest and principal payments through to the secondary market investor. The servicer also keeps the formal records of all transactions pertaining to the mortgage. In return for these services, the financial institution collects a monthly fee. Mortgage servicers generally charge fees ranging from 1/4 to 1/2 percent of the mortgage balance. Financial institutions can remove mortgages from their balance sheets through one of two mechanisms. First, they can pool their recently originated mortgages together and sell them in the secondary mortgage market. Second, financial institutions can issue mortgage-backed securities, creating securities that are backed by their newly originated mortgages (i.e., securitization of mortgages).

History and Background of Secondary Mortgage Markets

www.fanniemae.com

www.va.com

The secondary mortgage markets were created by the federal government to help boost U.S. economic activity during the Great Depression. In the 1930s, the government established the Federal National Mortgage Association (FNMA or Fannie Mae) to buy mortgages from thrifts so that these depository institutions could make more mortgage loans. The government also established the Federal Housing Administration (FHA) and the Veterans Administration (VA) to insure certain mortgage contracts against default risk (described earlier). This made it easier to sell/securitize mortgages. Financial institutions originated the mortgages and secondary market buyers did not have to be as concerned with a borrower's credit history or the value of collateral backing the mortgage since they had a federal government guarantee protecting them against default risk.

www.ginniemae.gov

www.freddiemac.com

By the late 1960s, fewer veterans were obtaining guaranteed VA loans. As a result, the secondary market for mortgages declined. To encourage continued expansion in the housing market, the U.S. government created the Government National Mortgage Association (GNMA or Ginnie Mae) and the Federal Home Loan Mortgage Corporation (FHLMC or Freddie Mac), which provided direct or indirect guarantees that allowed for the creation of mortgage-backed securities (see below).

As the secondary mortgage markets have evolved, a wide variety of mortgage-backed securities have been developed to allow primary mortgage lenders to securitize their

mortgages and to allow a thriving secondary market for mortgages to develop. The organizations involved in the secondary mortgage markets (e.g., GNMA, FNMA) differ in the types of mortgages included in the mortgage pools, security guarantees (or insurance), and payment patterns on the securities.

Mortgage Sales

Financial institutions have sold mortgages and commercial real estate loans among themselves for more than 100 years. In fact, a large part of **correspondent banking** involves small banks making loans that are too big for them to hold on their balance sheets—either for lending concentration risk or capital adequacy reasons—and selling parts of these loans to large banks with whom they have had a long-term deposit and lending correspondent relationship. In turn, large banks often sell parts of their loans, called *participations,* to smaller banks.

correspondent banking
A relationship between a small bank and a large bank in which the large bank provides a number of deposit, lending, and other services.

A **mortgage sale** occurs when a financial institution originates a mortgage and sells it with or without recourse to an outside buyer. If the mortgage is sold without recourse, the financial institution not only removes it from its balance sheet but also has no explicit liability if the mortgage eventually goes bad. Thus, the buyer of the mortgage (not the financial institution that originated the loan) bears all the credit risk.[2] If, however, the mortgage is sold with **recourse,** under certain conditions the buyer can return the mortgage to the selling financial institution; therefore, the financial institution retains a contingent credit risk liability. In practice, most mortgage sales are without recourse. For example, in 2003, thrifts sold $628 billion of the primary mortgages from their asset portfolios: $498 billion (79.3 percent) of these were sold without recourse. Mortgage sales usually involve no creation of new types of securities, such as those described below. We discuss loan sales in more detail in Chapter 24.

mortgage sale
Sale of a mortgage originated by a bank with or without recourse to an outside buyer.

recourse
The ability of a loan buyer to sell the loan back to the originator should it go bad.

A major reason that financial institutions sell loans is to manage their credit risk better (see Chapter 20). Mortgage sales remove assets (and credit risk) from the balance sheet and allow a financial institution to achieve better asset diversification. Additionally, mortgage sales allow financial institutions to improve their liquidity risk and interest rate risk situations. Other than risk management, however, financial institutions are encouraged to sell loans for a number of other economic (generation of fee income) and regulatory reasons (including reducing the cost of reserve requirements and reducing the cost of holding capital requirement against mortgages).[3] The benefits of loan sales are discussed in detail in Chapter 24.

A wide array of potential buyers and sellers of mortgage loans exist. The five major buyers of primary mortgage loans are domestic banks, foreign banks, insurance companies and pension funds, closed-end bank loan mutual funds, and nonfinancial corporations. The major sellers of mortgage loans are money center banks, small regional or community banks, foreign banks, and investment banks. We discuss the motivations of each in Chapter 24.

Mortgage-Backed Securities

In this section, we introduce the three major types of mortgage-backed securities—the pass-through security, the collateralized mortgage obligation (CMO), and the mortgage-backed bond. In Chapter 24, we provide a detailed analysis of these securities and the processes by which these mortgage-backed securities are created.

Pass-through securities and CMOs are securitized mortgages. Securitization of mortgages involves the pooling of a group of mortgages with similar characteristics, the removal of these mortgages from the balance sheet, and the subsequent sale of interests in the mortgage pool to secondary market investors. Securitization of mortgages results in the creation of mortgage-backed securities (e.g., government agency securities, collateralized

2. Although the buyer's credit risk is reduced if the mortgage is federally insured against default risk.

3. Under the current BIS scheme (see Chapter 13), this is 2.8 percent for most residential mortgages.

TABLE 7–3 Government-Related Mortgage-Backed Pass-Through Securities Outstanding
(in billions of dollars)

	1995	1998	2000	2004
GNMA	$ 472.3	$ 537.4	$ 611.5	$ 572.1
FNMA	583.0	834.5	1,057.7	1,816.0
FHLMC	515.1	646.5	822.3	1,190.0
Private mortgage issuers	292.8	536.6	740.7	1,152.3
Total	$1,863.2	$2,582.0	$3,232.2	$4,730.4

Source: Federal Reserve Bulletin, various issues, Table 1.54, p. A35. **www.federalreserve.gov**

mortgage obligations), which can be traded in secondary mortgage markets. For example, there were $4.73 trillion in outstanding mortgage securitization pools at the end of 2004. The ability of mortgage issuers to remove mortgages (and the accompanying credit risk and interest rate risk) from their balance sheets has added billions of dollars to mortgage markets and resulted in lower rates and fees to mortgage borrowers.

Pass-Through Securities. Financial institutions frequently pool the mortgages and other assets they originate and offer investors an interest in the pool in the form of *pass-through certificates or securities.* **Pass-through mortgage securities** "pass through" promised payments of principal and interest on pools of mortgages created by financial institutions to secondary market investors (mortgage-backed security bond holders) holding an interest in these pools. After a financial institution accepts mortgages, it pools them and sell interests in these pools to pass-through security holders. Each pass-through mortgage security represents a fractional ownership share in a mortgage pool.[4] Thus, a 1 percent owner of a pass-through mortgage security issue is entitled to a 1 percent share of the principal and interest payments made over the life of the mortgages underlying the pool of securities. The originating financial institutions (e.g., bank or mortgage company) or a third-party servicer receives principal and interest payments from the mortgage holder and passes these payments (minus a servicing fee) through to the pass-through security holders.

pass-through mortgage securities

Mortgage-backed securities that "pass through" promised payments of principal and interest on pools of mortgages created by financial institutions to secondary market participants holding interests in the pools.

Three agencies, either government-owned or government-sponsored, are directly involved in the creation of mortgage-backed pass-through securities. Informally, they are known as Ginnie Mae (GNMA), Fannie Mae (FNMA), and Freddie Mac (FHLMC). Private mortgage issuers, such as banks and thrifts, also purchase mortgage pools, but they do not conform to government-related issuer standards. Table 7–3 reports the amount of mortgaged-backed pass-through securities outstanding for each from 1995 through 2004.

www.ginniemae.gov

GNMA. The Government National Mortgage Association (GNMA), or Ginnie Mae, began in 1968 when it split off from the Federal National Mortgage Association (FNMA). GNMA is a government-owned agency with two major functions: sponsoring mortgage-backed securities programs by financial institutions such as banks, thrifts, and mortgage bankers and acting as a guarantor to investors in mortgage-backed securities regarding the timely pass-through of principal and interest payments from the financial institution or mortgage servicer to the bond holder. In other words, GNMA provides **timing insurance**. In acting as a sponsor and payment-timing guarantor, GNMA supports only those pools of mortgage loans whose default or credit risk is insured by one of three government agencies: the Federal Housing Administration (FHA), the Veterans Administration (VA), and the Farmers Home Administration (FMHA). Mortgage loans insured by these agencies target

timing insurance

A service provided by a sponsor of pass-through securities (such as GNMA) guaranteeing the bond holder interest and principal payments at the calendar date promised.

4. This is a simplification. In actual practice, the mortgages are first sold (placed) in a "special purpose vehicle" (SPV) off the balance sheet, and it is this SPV that issues the bonds backed by the mortgages.

groups that might otherwise be disadvantaged in the housing market, such as low-income families, young families, and veterans. As such, the maximum mortgage under the FHA/VA/FMHA–GNMA securitization program is capped. The cap was $359,650 for a single family home in 2004.

GNMA securities are issued in minimum denominations of $25,000. The minimum pool size for GNMA single-family mortgages is $1 million. Once a pool of mortgages is packaged by a financial institution in accordance with GNMA specifications, pass-through securities can be issued. Cash flows of interest and principal received from the original mortgages are used to pay the promised payments on the GNMA securities. The mortgages from the pool are used as collateral, guaranteeing the promised payments to the GNMA holders.

GNMA requires that all of the mortgages in a pool used to back a particular GNMA pass-through security issue have the same interest rate. Secondary market purchasers of GNMA pass-through securities generally receive 0.50 percent less than the rate on the underlying mortgages. The 0.50 percent is divided between the financial institution that services the mortgages and GNMA, which charges a fee for the provision of its timing insurance.

www.fanniemae.com

FNMA. Originally created in 1938, the Federal National Mortgage Association (FNMA or Fannie Mae) is the oldest of the three mortgage-backed security-sponsoring agencies. It is now a private corporation owned by shareholders, with its stock traded on the New York Stock Exchange. However, in the minds of many investors, it still has implicit government backing, which makes it equivalent to a government-owned agency. Indeed, the fact that FNMA has a secured line of credit available from the U.S. Treasury should it need funds in an emergency supports this view. As a result, FNMA bonds are rated AAA. FNMA is a more active agency than GNMA in creating pass-through securities. GNMA merely sponsors such programs and guarantees the timing of payments from financial institution servicers to GNMA investors; FNMA actually helps create pass-throughs by buying and holding mortgages on its balance sheet; it also issues bonds directly to finance those purchases.

Specifically, FNMA creates mortgage-backed securities (MBSs) by purchasing packages of mortgage loans from banks and thrifts; it finances such purchases by selling MBSs to outside investors such as life insurers or pension funds. In addition, FNMA engages in swap transactions by which it swaps MBSs with a bank or thrift for original mortgages. Since FNMA guarantees securities in regard to the full and timely payment of interest and principal, the financial institution receiving the MBSs can then resell them in the capital market or can hold them in its own portfolio. Unlike GNMA, FNMA securitizes conventional mortgage loans, as well as FHA/VA insured loans, as long as the conventional loans have acceptable loan-to-value or collateral ratios not normally exceeding 80 percent. Conventional loans with high loan-to-value ratios usually require that the mortgages be insured with private mortgage insurance (see earlier discussion) before they are accepted into FNMA securitization pools.

www.freddiemac.com

FHLMC. The Federal Home Loan Mortgage Corporation (FHLMC), or Freddie Mac (FMAC), performs a similar function to that of FNMA except that its major securitization role has historically involved thrifts. Like FNMA, FHLMC is a stockholder-owned corporation with a line of credit from the U.S. Treasury. Thus, its bonds are also rated AAA. Further, like FNMA, it buys mortgage pools from financial institutions and swaps MBSs for loans. FHLMC also sponsors conventional mortgage pools and mortgages that are not federally insured as well as FHA/VA mortgage pools and guarantees timely payment of interest and ultimate payment of principal on the securities it issues.

Private Mortgage Pass-Through Issuers. Private mortgage pass-through issuers (such as commercial banks, thrifts, and private conduits) purchase nonconforming mortgages (e.g., mortgages that exceed the size limit set by government agencies, such as the $359,650 cap

TABLE 7–4 Pass-Through Securities Quote Sheet

(1) (2) (3) (4) (5) (6) (7) (8)

Mortgage-Backed Securities

Indicative, not guaranteed; from Bear Stearns Cos./Street Pricing Service

RATE		PRICE (JAN) (PTS-32DS)	PRICE CHANGE (32DS)	AVG LIFE (YEARS)	SPRD TO AVG LIFE (YEARS)	SPREAD CHANGE (BPS)	PSA (PREPAY SPEED)	YIELD TO MAT*
30-year								
FMAC GOLD	5.5%	101-17	+02	4.7	157	-1	357	5.10
FMAC GOLD	6.0%	103-07	-02	2.6	150	-1	636	4.60
FMAC GOLD	6.5%	104-27	-02	1.8	58	-3	750	3.44
FNMA	5.5%	101-15	+02	4.6	156	-1	364	5.08
FNMA	6.0%	103-10	-01	2.4	131	-1	704	4.34
FNMA	6.5%	104-29	-02	1.6	26	-3	799	3.07
GNMA **	5.5%	101-31	+02	4.9	143	-4	325	5.01
GNMA **	6.0%	103-16	-02	2.6	138	-1	574	4.48
GNMA **	6.5%	105-07	-01	2.0	70	-4	648	3.65
15-year								
FMAC GOLD	5.0%	101-17	+02	4.4	112	-2	278	4.58
FNMA	5.0%	101-18	+02	4.2	109	-2	298	4.52
GNMA **	5.0%	102-13	+01	4.3	89	-2	275	4.34

*Extrapolated from benchmarks based on projections from Bear Stearns prepayment model, assuming interest rates remain unchanged. ** Government guaranteed

Source: *The Wall Street Journal,* December 8, 2004, p. C9. Reprinted by permission of *The Wall Street Journal.* © 2004 Dow Jones & Company, Inc. All Rights Reserved Worldwide. **www.wsj.com**

set by the FHA), pool them, and sell pass-through securities on which the mortgage collateral does not meet the standards of a government-related mortgage issuer. There are a limited number of private conduits—Prudential Home, Residential Funding Corporation, GE Capital Mortgages, Ryland/Saxon Mortgage Countrywide, Chase Mortgage Finance, and Citigroup/Citibank Housing. Private mortgage pass-through securities must be registered with the SEC and are generally rated by a rating agency (such as Moody's) in a manner similar to corporate bonds.

Mortgaged-Backed Pass-Through Quotes. Table 7–4 presents a quote sheet for mortgage-backed pass-through securities traded on December 7, 2004. The quote lists the trades by issuer (e.g., GNMA, FNMA). Column 1 of the quote lists the sponsor of the issue (e.g., FMAC, FNMA, GNMA), the stated maturity of the issue (30 years or 15 years), the mortgage coupons on the mortgages in each pool (e.g., 5.5 percent), and information about the maximum delay between the receipt of interest by the servicer/sponsor and the actual payment of interest to bond holders. The "GOLD" next to FMAC indicates a maximum stated delay of 55 days. The current market price of a bond is shown in column 2, with the daily price change in column 3. Both prices are in percentages, and the number after the dash is in 32nds (e.g., 101-17 = $101\frac{17}{32}$). Column 4 shows the average life of the bond reflecting the prepayment patterns of homeowners in the pool as estimated by one investment bank (Bear Stearns). Notice these pools of 15- and 30-year mortgages have an expected weighted-average life[5] of no more than 4.9 years. The fifth column in the quote is a measure of the yield spread of the mortgage-backed security over a Treasury bond with the same average life, and column 6 reports the spread change for the day. Column 7 is a measure of the estimated prepayment speed. The prepayment speeds are shown relative to those normally occurring on pass-through securities as estimated by the Public Securities Association (PSA). Thus, 357 PSA (prepayment speed) means that these MBS mortgage holders are prepaying over $3\frac{1}{2}$ times quicker than the speed that normally would be expected. One possible reason for this is that current interest rates are low and many mortgage holders are

5. The weighted-average life of these securities is not the same as duration, which measures the weighted-average time to maturity based on the relative present values of cash flows as weights. Rather, the weighted-average life is a significant simplification of the duration measure that seeks to concentrate on the expected timing of repayments of principal; i.e., it is the weighted-average time over which principal repayments will be received.

prepaying early to refinance new mortgages at lower rates. We discuss prepayment risk and prepayment speeds as estimated by the PSA in greater detail in Chapter 24. Finally, the last column (8) is the yield to maturity on the mortgage-backed pass-through security. This yield is calculated using the yield to maturity formulas found in Chapter 3, given the contractual income, principal cash flows, and the expected prepayment pattern (based on projections made by Bear Stearns).

Government Sponsorship and Oversight of FNMA and Freddie Mac. As mentioned above, while neither FNMA nor Freddie Mac is fully backed by the U.S. government, both are sponsored by the U.S. government. For example, both have a secured line of credit available from the U.S. Treasury. The implicit guarantee afforded by this government sponsorship leads investors to believe the government would step in if the agencies had trouble. This, in turn, allows FNMA and Freddie Mac to borrow more cheaply than virtually all other mortgage issuers.

This special relationship between FNMA, Freddie Mac, and the U.S. government, and the subsidy that goes with this relationship, sparked a public policy debate in the early 2000s. Many have raised concerns that these two government-sponsored enterprises **(GSEs)** may not be the most efficient mechanisms for subsidizing housing. Yet both GSEs have experienced persistently high profit, arguably the result of the "federal" guarantee or subsidy. As a result, some regulators have argued that FNMA and Freddie Mac be fully privatized by cutting their links to U.S. government guarantees. Others have called for the creation of new U.S. government–sponsored competitors to FNMA and Freddie Mac so as to reduce the size of the government subsidy going to these two GSEs.

GSE

A government-sponsored enterprise such as Fannie Mae and Freddie Mac.

www.hud.gov

www.ofheo.gov

Another issue of concern relates to the safety and soundness of these GSEs. The U.S. government sponsorship of FNMA and Freddie Mac creates the potential for moral hazard (increased risk-taking behavior) and raises concerns as to the problems that would arise if these GSEs became financially distressed or even insolvent. In response to these concerns, the U.S. government assigned two safety and soundness regulators to focus exclusively on these housing GSEs: the Department of Housing and Urban Development (HUD) and the Office of Federal Housing Enterprise Oversight (OFHEO). Further, in 2002 (in the wake of the Enron collapse) regulators introduced legislation that would require FNMA and Freddie Mac to register their bonds with the Securities and Exchange Commission (SEC). To date these GSEs are exempt from SEC disclosure rules. Federal Reserve chairman Alan Greenspan expressed his concern that banks that sell derivatives to FNMA and Freddie Mac might be taking on too much risk because these banks believe the GSEs are implicitly supported by the government.[6] In response, both FNMA and Freddie Mac started reporting more information about their derivatives positions to investors.[7]

In the early 2000s, these two agencies came under fire for several reasons. First, in September 2002 Fannie Mae was criticized for allowing a sharp increase in interest rate risk to exist on its balance sheet. The Office of Federal Housing Enterprise Oversight (OFHEO), a main regulator of Fannie Mae, required Fannie Mae to submit weekly reports to the OFHEO on the company's exposure to interest rate risk. The OFHEO also instructed Fannie Mae to keep regulators apprised of any challenges associated with returning its interest rate risk measure to more acceptable levels, and it warned that the office might take additional action if Fannie Mae's management's effectiveness in lowering interest rate risk suffered adverse developments. Despite these actions, Fannie Mae reported a 52 percent drop in net income for 2003, attributed to wide swings in the value of derivative contracts used to hedge interest rate risk.

6. For example, both agencies are major purchasers of credit derivatives such as credit swaps (see Chapter 23) and paid premiums in 2002 of around $2,800 per $1 million of protection. By comparison, Merrill Lynch was paying $10,000 per million—see, "The Debt Nobody Frets Over," *International Herald Tribune,* May 22, 2002, p. 12.

7. See "Fannie Mae and Freddie Mac Pressed Again, This Time on Disclosure and Derivatives," *New York Times,* April 25, 2002, p. C2, by Alex Beresson and "Freddie Mac, Fannie Mae Face Disclosure Rules," *The Wall Street Journal,* July 2, 2002, p. A2.

In October 2003, Fannie Mae and Freddie Mac came under new criticism for allegedly overcharging lenders for services they provide. The overcharges came in the fees that the companies collect from banks, thrifts, and other lenders for guaranteeing repayment of their mortgages. If true, the overcharges hurt mortgage lenders, squeezing their profit margins and perhaps home buyers, too, as lenders increased mortgage interest rates to recover the increased fees. Later that same month Fannie Mae announced that it miscalculated the value of its mortgages, forcing it to make a $1.1 billion restatement of its stockholders equity. Earlier in the year Freddie Mac announced a $4.5 billion misstatement of its earnings. Although both were claimed to be computational errors, the episodes reinforced fears that Fannie Mae and Freddie Mac managers lack the necessary skills to operate their massive and complex businesses, which some investors and political critics worry could pose risk to the nation's financial system if not properly managed. In the fall of 2004, these apparent errors led to an investigation by the OFHEO into the accounting practices of both GSEs. The OFHEO found evidence that Fannie Mae's accounting practices had been designed to skirt accepted accounting practices, smooth earnings, and, in at least one case, increase bonuses to executives. In September 2004, Freddie Mac admitted that it distorted its financial statements to give investors a picture of smooth earnings and agreed to pay a $125 million civil penalty for using derivative transactions and other accounting practices to make earnings look less volatile.

Finally, in February 2004, Federal Reserve chairman Alan Greenspan stated that Fannie Mae and Freddie Mac pose very serious risks to the U.S. financial system and urged Congress to curb their growth sooner rather than later. The fear is that the two agencies used their implicit federal backing to assume more risk and finance expansion through increased debt. Such actions create a source of systematic risk for the U.S. financial system.

As a result of these problems and the potential risk to the financial system, in July 2004 the Treasury Department was given the authority to limit future debt issuance by Fannie Mae and Freddie Mac. This was seen as a positive step in curbing the enormous growth, financed through borrowing, of the GSEs and a way to reduce fears among government officials, competitors of the GSEs, and investors that the two agencies posed growing risks to the financial system. Further, in 2004 the U.S. Senate proposed a bill that would create a new independent regulator of Fannie Mae and Freddie Mac with broad authority to determine the companies' safety and soundness, capital standards, and new lines of business, and even to decide the companies' ultimate fate in the event of insolvency. The OFHEO followed up the Senate's actions by drafting a rule that would spell out how it could take over and wind down Fannie Mae and Freddie Mac's operations if they ever get into financial trouble. Adoption of that rule would send a strong signal to investors that the two agencies are not fully guaranteed by the U.S. government and not immune from market forces.[8]

Collateralized Mortgage Obligations. Although pass-throughs are still the primary mechanism for securitization, the **collateralized mortgage obligation (CMO)** is a second vehicle for securitizing financial institution assets that is increasingly used. Innovated in 1983 by FHLMC and First Boston, the CMO is a device for making mortgage-backed securities more attractive to certain types or classes of investors. The CMO does this by repackaging the cash flows from mortgages and pass-through securities in a different fashion.

collateralized mortgage obligation (CMO)

A mortgage-backed bond issued in multiple classes or tranches.

A pass-through security gives each investor a pro rata share of any interest and principal cash flows on a mortgage pool. By contrast, a CMO can be viewed as a multiclass pass-through with a number of different bond holder classes or **tranches**. Unlike a pass-through, which has no guaranteed annual coupon, each bond holder class in a CMO has a different

tranche

A bond holder class associated with a CMO.

8. See "Fannie, Freddie Face a Tough Plan," by John D. McKinnon, *The Wall Street Journal,* March 29, 2004, p. A2; "Regulators Hit Fannie, Freddie with New Assault," by James R. Hagerty, *The Wall Street Journal,* April 28, 2004, p. A1; "Fannie, Freddie May Get Limits," by John D. McKinnon and James R. Hagerty, *The Wall Street Journal,* July 16, 2004, p. C1; "Regulator Details a Wide Range of Accounting Problems at Fannie," by James R. Hagerty, John D. McKinnon, and Dawn Kopecki, *The Wall Street Journal,* September 23, 2004, p. A1.

guaranteed coupon (paid semiannually) just as a regular T-bond. More importantly, the allocation of any excess cash flows over and above the guaranteed coupon payments due to increased mortgage prepayments go toward retiring the principal outstanding of only one class of bond holders, leaving all other classes prepayment protected for a period of time.[9] CMOs give investors greater control over the maturity of the mortgage-backed securities they buy. By comparison, for pass-throughs, the mortgage-backed security holder has a highly uncertain maturity date due to the risk of very rapid prepayments (called *prepayment risk by the mortgagees*).

mortgage- (asset-) backed bonds

Bonds collateralized by a pool of assets.

Mortgage-Backed Bond. **Mortgage- (asset-) backed bonds** (MBBs) are the third type of mortgage-backed security. These bonds differ from pass-throughs and CMOs in two key dimensions. First, while pass-throughs and CMOs help financial institutions remove mortgages from their balance sheets, MBBs normally remain on the balance sheet. Second, pass-throughs and CMOs have a direct link between the cash flows on the underlying mortgages and the cash flows on the bond instrument issued. By contrast, the relationship for MBBs is one of collateralization rather than securitization; the cash flows on the mortgages backing the bond are not necessarily directly connected to interest and principal payments on the MBB.

Essentially, a financial institution issues an MBB to raise long-term low-cost funds. MBB holders have a first claim to a segment of the financial institution's mortgage assets. Practically speaking, the financial institution segregates a group of mortgage assets on its balance sheet and pledges this group of assets as collateral against the MBB issue.

DO YOU UNDERSTAND?

1. [illegible]
2. [illegible]
3. [illegible]

A trustee normally monitors the segregation of assets and ensures that the market value of the collateral exceeds the principal owed to MBB holders. Financial institutions back most MBB issues by excess collateral. This excess collateral backing of the bond, in addition to the priority rights of the bond holders, generally ensures the sale of these bonds with a high investment grade credit rating (BBB or better). In contrast, the financial institution, when evaluated as a whole, could be rated as BB or even lower. A high credit rating results in lower coupon payments than would be required if significant default risk had lowered the credit rating.

Weighed against the benefits of MBB issuance are a number of costs. The first cost is that MBBs tie up mortgages on the financial institution's balance sheet for a long time. This decreases the asset portfolio's liquidity. Second, balance sheet illiquidity is enhanced by the need to overcollateralize MBBs to ensure a high-quality credit risk rating for the issue. Third, by keeping the mortgages on the balance sheet, the financial institution continues to be liable for capital adequacy and reserve requirement taxes. Because of these costs, MBBs are the least used of the three basic vehicles of securitization.

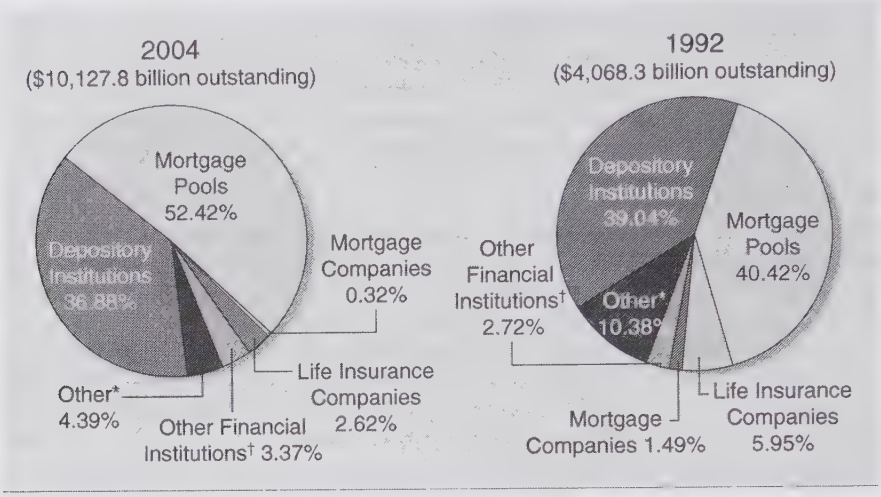
PARTICIPANTS IN THE MORTGAGE MARKETS

In this chapter, we have demonstrated that financial institutions are critical in the operations of both the primary and secondary mortgage markets. Some financial institutions (e.g., banks, savings institutions) contribute mainly to the primary mortgage markets. Others (e.g., mortgage companies) contribute to both the primary and secondary markets. Figure 7–8 shows the distribution of mortgages outstanding in 1992 and 2004 by type of mortgage holder—the ultimate investor.

Notice in Figure 7–8 the growth in the importance of mortgage securitization pools over the period (40.42 percent of all mortgages outstanding in 1992 versus 52.42 percent in 2004).

9. Some CMOs, however, are issued with planned amortization class (PAC) bonds. PAC bonds offer a fixed principal redemption schedule that is met as long as prepayments on the underlying mortgages remain within a certain range. PACs are designated to protect CMO investors against prepayment risk. See discussion in Chapter 24.

FIGURE 7–8 Mortgages Outstanding by Type of Holder, 1992 and 2004



*Includes households, businesses, state and local governments, and the federal government.

†Includes other insurance companies, pension funds, finance companies, and REITs.

Source: Federal Reserve Board Web site, "Flow of Fund Accounts," September 2004. **www.federalreserve.gov**

Remember that government-sponsored mortgage pools were virtually nonexistent before the establishment of GNMA in 1968. By contrast, mortgages held by life insurance companies, households, businesses, and the federal government have fallen as a percentage of the total pool of mortgages outstanding (5.95 percent for life insurance companies in 1992 versus 2.62 percent in 2004; 10.38 percent for households, businesses, and government in 1992 versus 4.39 percent in 2004).

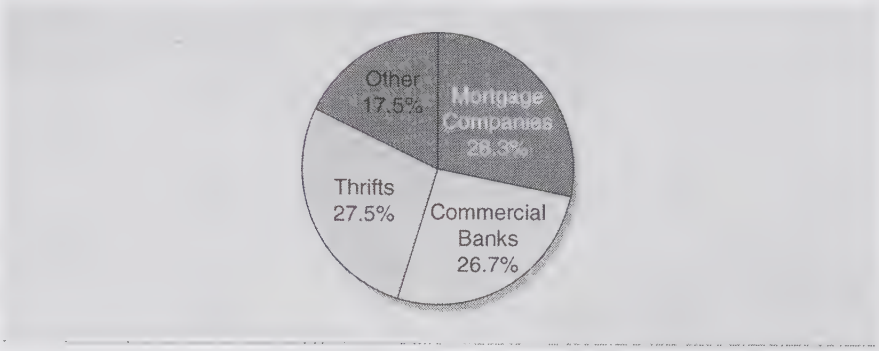
Notice that the actual holdings of mortgages by specialized mortgage companies (such as Sierra Pacific Mortgage Company and Greenwich Home Mortgage Corp. of New Jersey) are small (1.49 percent in 1992 and 0.32 percent in 2004). Mortgage companies, or mortgage bankers, are financial institutions[10] that originate mortgages and collect payments on them. Unlike a bank or thrift, mortgage companies typically do not hold on to the mortgages they originate. Instead, they sell the mortgages they originate but continue to service the mortgages by collecting payments and keeping records on each loan. Mortgage companies earn income to cover the costs of originating and servicing the mortgages from the servicing fees they charge the ultimate buyers of mortgages. Figure 7–9 shows the distribution of one- to four-family mortgage originations; mortgage companies originated 28.3 percent of all home mortgages in 2004. Mortgage companies are major originators of FHA- and VA-insured mortgage pass-throughs sponsored by GNMA. Figure 7–10 shows the distribution of issuers of GNMA securities; mortgage companies issued over half of all GNMA securities in 2004. What should be evident from these figures is that despite originating such a large volume in the mortgage market, the reason for the small investments in mortgages by mortgage companies (as seen in Figure 7–7) is that, while mortgage companies are major *originators* of home mortgages, they generally do not *hold* the mortgage loans in their asset portfolios for a long period of time. Rather, mortgage companies *sell* or *securitize* most of the mortgages they originate in the secondary market.

DO YOU UNDERSTAND?

1. Why [illegible] mortgages in the United States [illegible]?

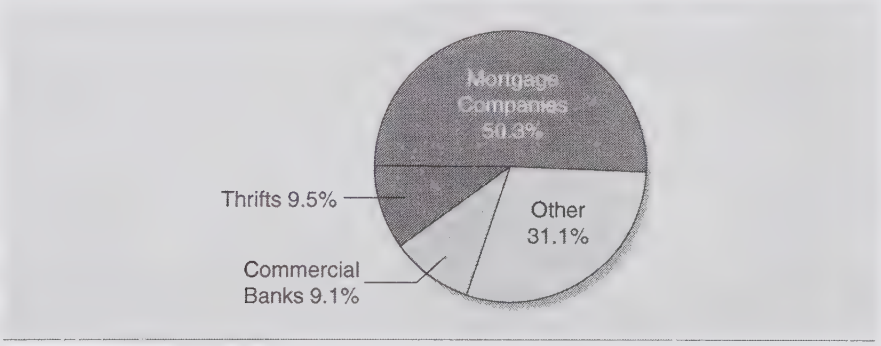
10. Most of these mortgage companies are finance companies, which are discussed in Chapter 14.

FIGURE 7–9 One- to Four-Family Mortgage Originations

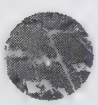


Source: Federal Home Loan Bank Web site, December 2004. **www.fhfb.gov**

FIGURE 7–10 Issuers of Ginnie Mae Securities



Source: Ginnie Mae Web site, December 2004. **www.ginniemae.gov**



INTERNATIONAL TRENDS IN SECURITIZATION

10

Demand by International Investors for U.S. Mortgage-Backed Securities

International investors participate in U.S. mortgage and mortgage-backed securities markets. Table 7–5 lists the dollar value of primary mortgages issued and held by foreign banking offices in the United States between 1992 and 2004. Notice that the value of mortgages held by foreign banks has decreased over this period by 71 percent (from $51.6 billion in 1992 to $15.5 billion in 2004). This compares to primary mortgages issued and held by domestic depository institutions of $3,734.9 billion in 2004 (see Figure 7–8)—foreign bank offices issue and hold less than 0.5 percent of the total primary mortgage market in the United States.

International Mortgage Securitization

While they have not evolved to the level of U.S. mortgage markets, securitization vehicles have also been developed for mortgages in countries other than the United States. After the United States, Europe is the world's second-largest and most developed securitization market. Although a form of securitization has been in existence in Europe in the German and Danish mortgage markets since the 1700s, securitization as we currently know it

TABLE 7–5 Foreign Investments in U.S. Mortgage Markets
(in billions of dollars)

	1992	1995	1998	2000	2004
Mortgages held by foreign banking offices in the United States	$51.6	$35.1	$20.6	$17.1	$15.5

Source: Federal Reserve Board Web site, "Flow of Fund Accounts," various issues. **www.federalreserve.gov**

DO YOU UNDERSTAND?

emerged outside the United State only in the mid-1980s. The original growth of "modern" securitization in Europe was based largely upon the activities of a small number of centralized lenders in the booming U.K. residential mortgage market of the late 1980s.

Since mid-1993, the number of European originators of securitized assets has continued to grow, as have the types of assets that can be securitized and the investor base. Further, securitization costs have fallen, and legislative and regulatory changes in European countries have supported this market's growth. The volume of European securitizations skyrocketed in 1996 and 1997, when European countries securitized a total of $41.5 billion assets. Despite the world economic crisis in 1998, the European securitization market fell only slightly to $38.4 billion. More than $22 billion of securitized vehicles were issued in just the first half of 1999 alone, including $3.5 billion in international deals from Japan. Japan and Europe accounted for $16 billion of the first quarter total. Latin America and the emerging markets (still struggling with economic crises) lagged behind, with issues totaling $7.0 billion.

The European securitization market topped $218 billion in 2003 and $192 billion in the first nine months of 2004. The United Kingdom is the biggest issuer of mortgage-backed securities with over 30 percent of the European market. Germany is second, but far behind the United Kingdom, with 5 percent of the European market.[11] In Europe, the factors driving the securitization market include the conversion to a single currency (a factor driving many European markets at the beginning of the 21st century), the effects of globalization of all markets, and the spread of U.S.-style financial securities. The single currency, the euro, has accentuated the increased trend in securitization in Europe; issuers are able to securitize combined assets in the Euro with minimal currency risk while benefiting from a bigger and more diversified pool of buyers. Future expectations are that securitized assets will be denominated almost exclusively in dollars and euros, with euros potentially becoming more liquid than the dollar.

In Russia, mortgage lending has grown in the early 2000s, following the enactment of many crucial laws that were meant to encourage mortgage loans. Such basic laws as the right to own property and land, the right to sell it, and the right to pledge it as security for a mortgage did not exist in Russia until recently. In addition, a Federal Mortgage Agency was set up and mortgage terms have become more favorable. The maximum term on a mortgage was extended to 20 years from 5 and interest rates in Russia fell from 24 percent to 15 percent. In addition, a secondary mortgage market was created. DeltaCredit, a private Russian-U.S. joint venture, started operating as Russia's first specialized mortgage bank. The International Finance Corporation extended a $20 million credit line to DeltaCredit for housing finance in 2002 and another $66 million in 2003. In October 2003 five more international banks announced their intention to enter the Russian mortgage market. As of 2003 mortgage lending in Russia totaled around $200 million. Estimates suggest that this can grow to $10 billion to $30 billion. The huge demand for more and better housing, coupled with fast progress in the mortgage market, should boost household credit in coming years.[12]

11. See "Europe at an Interesting Crossroads," *Asset Securitization Report,* November 2004.

12. See "The Beginning of Russia's Mortgage Boom," *Quest Economics Database,* November 30, 2003.

SUMMARY

In this chapter, we examined the primary and secondary mortgage markets. For several reasons, mortgages are analyzed separately from other capital market securities (e.g., bonds and stocks). We identified several characteristics associated with mortgages and various categories of primary mortgage markets. We also provided an overview of the secondary mortgage markets.

Securitization of mortgages allows financial institutions to reduce interest rate risk exposure experienced when mortgages are left in the asset portfolios for the entire life of the mortgage. We look at the details of the securitization process in a risk-return framework in Chapter 24.

SEARCH THE SITE

Go to the Federal Reserve Board's Web site at **www.federalreserve.gov** and find the most recent data on Mortgage Loans Outstanding.

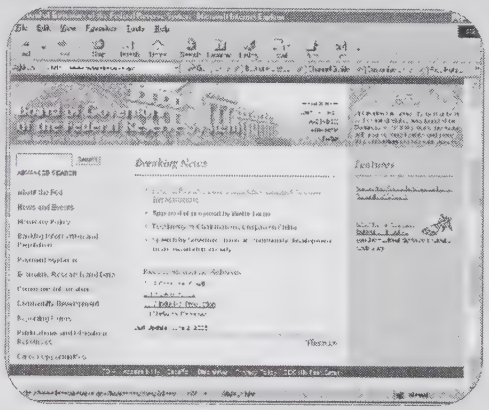
Click on "Economic Research and Data"

Click on "Statistics: Releases and Historical Data"

Click on "Flow of Fund Accounts of the United States, Releases"

Click on the most recent date.

Click on "Level tables"



This downloads a file onto your computer that contains the relevant data in Table L217.

Questions

1. What is the current dollar value of mortgage loans outstanding? How has this value changed since 2004 reported in Figure 7–1?
2. Calculate the percentage of mortgage loans outstanding comprised of 1- to 4-family, multifamily residential, commercial, and farm loans?

QUESTIONS

1. Why are mortgage markets studied as a separate capital market?
2. What are the four major categories of mortgages and what percentage of the overall market does each entail?
3. What is the purpose of putting a lien against a piece of property?
4. Explain the difference between a federally insured mortgage and a conventional mortgage.
5. Explain the difference between a fixed-rate mortgage and an adjustable-rate mortgage. Include a discussion of mortgage borrowers' versus mortgage lenders' preferences for each.
6. You plan to purchase a $100,000 house using a 30-year mortgage obtained from your local credit union. The mortgage rate offered to you is 8.25 percent. You will make a down payment of 20 percent of the purchase price.
   a. Calculate your monthly payments on this mortgage.
   b. Calculate the amount of interest and, separately, principal paid in the 25th payment.
   c. Calculate the amount of interest and, separately, principal paid in the 225th payment.
   d. Calculate the amount of interest paid over the life of this mortgage.
7. You plan to purchase a $175,000 house using a 15-year mortgage obtained from your local bank. The mortgage rate offered to you is 7.75 percent. You will make a down payment of 20 percent of the purchase price.
   a. Calculate your monthly payments on this mortgage.

b. Calculate the amount of interest and, separately, principal paid in the 60th payment.
c. Calculate the amount of interest and, separately, principal paid in the 180th payment.
d. Calculate the amount of interest paid over the life of this mortgage.

8. You plan to purchase an $80,000 house using a 15-year mortgage obtained from your local bank. The mortgage rate offered to you is 8.00 percent. You will make a down payment of 20 percent of the purchase price.
a. Calculate your monthly payments on this mortgage.
b. Calculate the amount of interest and, separately, principal paid in the 127th payment.
c. Calculate the amount of interest and, separately, principal paid in the 159th payment.
d. Calculate the amount of interest paid over the life of this mortgage.

9. eXcel **Using a Spreadsheet to Calculate Mortgage Payments:** What is the monthly payment on a $150,000, 15-year mortgage if the mortgage rate is 5.75 percent? 6.25 percent? 7.5 percent? 9 percent?

Present Value	Periods	Interest Rate	=>	The Payment Will Be
$150,000	15 × 12	5.75%/12		$1,245.62
150,000	15 × 12	6.25%/12		1,286.13
150,000	15 × 12	7.50%/12		1,390.52
150,000	15 × 12	9.00%/12		1,521.40

10. eXcel **Using a Spreadsheet to Calculate Mortgage Payments:** What is the monthly payment on a $150,000, 30-year mortgage if the mortgage rate is 5.75 percent? 6.25 percent? 7.5 percent? 9 percent?

Present Value	Periods	Interest Rate	=>	The Payment Will Be
$150,000	30 × 12	5.75%/12		$ 875.36
150,000	30 × 12	6.25%/12		923.58
150,000	30 × 12	7.50%/12		1,048.82
150,000	30 × 12	9.00%/12		1,206.93

11. You plan to purchase a house for $115,000 using a 30-year mortgage obtained from your local bank. You will make a down payment of 20 percent of the purchase price.
a. Your bank offers you the following two options for payment:
Option 1: Mortgage rate of 9 percent and zero points.
Option 2: Mortgage rate of 8.85 percent and 2 points.
Which option should you choose?
b. Your bank offers you the following two options for payments:
Option 1: Mortgage rate of 10.25 percent and 1 point.
Option 2: Mortgage rate of 10 percent and 2.5 points.
Which option should you choose?

12. What is the difference between a graduated-payment mortgage and a growing-equity mortgage?

13. What is the difference between a shared-appreciation mortgage and an equity-participation mortgage?

14. How did the U.S. secondary mortgage markets evolve?

15. What is a mortgage sale? How does a mortgage sale differ from the securitization of mortgage?

16. What is a pass-through security?

17. What is the Government National Mortgage Association? How does this organization play a role in secondary mortgage markets?

18. What is the Federal National Mortgage Association? How does this organization play a role in secondary mortgage markets?

19. STANDARD &POOR'S Go to the S&P Educational Version of Market Insight Web site at **www.mhhe.com/edumarketinsight** and find the debt-to-equity ratio for the Federal Home Loan Mortgage Corp (FRE) and Fannie Mae (FNM) using the following steps: Click on "Educational Version of Market Insight" Enter your Site ID and click on "Login" Click on "Company" In the box marked "Ticker" enter FRE and click on "Go!" Click on "Excel Analytics" Click on "FS Ann. Balance Sheet"

This brings up a file that contains the relevant data: total liabilities and total shareholders' equity. Repeat this process using the ticker FNM.

20. Describe a collateralized mortgage obligation. How is a CMO created?

21. What is a mortgage-backed bond? Why do financial institutions issue MBBs?

Chapter 7

Stock Markets

OUTLINE

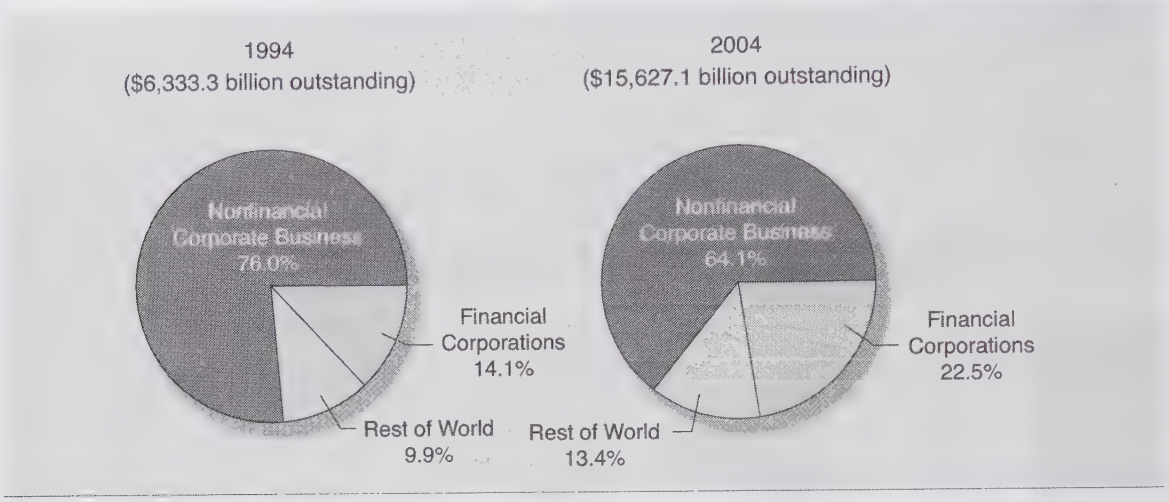
Chapter NAVIGATOR

1. What are the [illegible] characteristics of common stock?
2. What are the major characteristics of preferred stock?
3. What is the process by which common stock is issued in primary markets?
4. What are the major secondary stock markets?
5. What is the process by which a trade takes place in the stock markets?
6. What are the major stock market indexes?
7. Who are the major stock market participants?
8. What are the three forms of market efficiency?
9. What are the major characteristics of international stock markets?

THE STOCK MARKETS: CHAPTER OVERVIEW

Stock markets allow suppliers of funds to efficiently and cheaply get equity funds to public corporations (users of funds). In exchange, the fund users (firms) give the fund suppliers ownership rights in the firm as well as cash flows in the form of dividends. Thus, corporate stock or equity serves as a source of financing for firms, in addition to debt financing or retained earnings financing. In the 1990s, the market value of corporate stock outstanding increased faster than any other type of financial security. Figure 9–1 shows the market value of corporate stock issued in the United States from 1994 through 2004 by type of issuer. Notice that from 1994 through 2004, stock values increased 147 percent (increasing 170 percent from 1994 through 2000 before falling 13.6 percent in value in 2001 as the U.S. economy hit a downturn) compared to 86.8 percent growth in bond values (see Figure 6–1) and 130.4 percent growth in primary mortgage market values (see Figure 7–1).

FIGURE 9–1 Market Value of Common Stock Outstanding, by Type of Issuer



Source: Federal Reserve Board Web site, "Flow of Fund Accounts," various issues. **www.federalreserve.gov**

Legally, holders of a corporation's common stock or equity have an ownership stake in the issuing firm that reflects the percentage of the corporation's stock they hold. Specifically, corporate stockholders have the right to a share in the issuing firm's profits, as in dividend payments, after the payment of interest to bond holders and taxes. They also have a residual claim on the firm's assets if the company fails or is dissolved after all debt and tax liabilities are paid. Bond holders, on the other hand, are creditors of the issuing firm. They have no direct ownership interest in the firm, but they have a superior claim to the firm's earnings and assets relative to that of stockholders.

Further, common stockholders have voting privileges on major issues in the firm such as the election of the board of directors. It is the board of directors that oversees the day-to-day operations of the firm. The board is charged with ensuring that the firm is being run so as to maximize the value of the firm (i.e., the value of its equity and debt claims). Thus, while stockholders have no direct control over a firm's day-to-day operations, they do decide on who will oversee these operations and they can replace the board when they feel the firm is not being run efficiently from a value-maximizing perspective.

The secondary market for corporate stock is the most closely watched and reported of all financial security markets. Daily television and newspaper reports include recaps of the movements in stock markets (both in the United States and abroad). This is because stock market movements are sometimes seen as predictors of economic activity and performance. This is also because corporate stocks may be the most widely held of all financial securities. Most individuals own stocks either directly or indirectly through pension fund and mutual fund investments, and thus their economic wealth fluctuates closely with that of the stock market.

In this chapter, we present a description of equity or stock securities and the markets in which they trade. We begin with a description of the different types of corporate stock. We next look at how they are sold to the public and then traded; first in primary markets (the original sale) and then in secondary markets (the markets for resale). We also review the major stock market indexes. We look at the participants in stock markets and other issues relating to those markets (such as the link between stock market indexes and the overall economic activity, the efficiency of the stock market, and regulations covering stock market operations). We conclude the chapter with an examination of international participation in U.S. stock markets and some characteristics of foreign stock markets.

TABLE 9–1 New Securities Issued
(in billions of dollars)

	1992	1994	2000	2001	2003	2004[1]
Preferred	$21.33	$21.20	$ 16.91	$ 29.30	$33.14	$21.54
Common	57.10	107.60	175.79	115.25	81.03	93.81

[1]Through September.

Source: Federal Reserve Bulletin, Table 1.46, various issues, and Thompson Financial Web site.
www.federalreserve.gov; www.tfibcm.com

STOCK MARKET SECURITIES

Two types of corporate stock exist: common stock and preferred stock. While all public corporations issue common stock, many do not offer preferred stock. Both types of stock offer investors a two-part rate of return. The first part is capital gains if the stock appreciates in price over time.[1] The second part is the periodic (generally quarterly) dividend payments to the stockholder. Preferred stock dividends are generally preset at a fixed rate, while common stock dividends vary over time and are thus more uncertain (see below). Thus, the return to a stockholder over a period $t-1$ to t can be written as:

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} + \frac{D_t}{P_{t-1}}$$

where

P_t = Stock price at time t
D_t = Dividends paid over time $t-1$ to t
$\frac{P_t - P_{t-1}}{P_{t-1}}$ = Capital gain over time $t-1$ to t
$\frac{D_t}{P_{t-1}}$ = Return from dividends paid over time $t-1$ to t

EXAMPLE 9–1 Calculation of Return on a Stock

Suppose you owned a stock over the last year. You originally bought the stock for $40 ($P_{t-1}$) and just sold it for $45 ($P_t$). The stock also paid an annual dividend of $4 on the last day of the year. Your return on the stock investment can be calculated as follows:

$$R_1 = \frac{\$45 - \$40}{\$40} + \frac{\$4}{\$40}$$
$$= 12.5\% + 10.0\% = 22.5\%$$

or your return on the stock over the last year was 22.5 percent, 12.5 percent from capital gains and 10.0 percent from dividends.

We also looked at the calculation of the rate of return on corporate stocks in the Appendix 3A to Chapter 3, located at the book's Web site (**www.mhhe.com/sc3e**).

Table 9–1 shows the annual issuance of new common and preferred stock sold to new and existing stockholders from 1992 through 2004. Notice that preferred stock represents a small but growing portion of the new issue market (16 percent in 1995 and 1998 and 29 percent in 2003). Indeed, the majority of public corporations do not have preferred stock outstanding.

1. If the stock price falls, then the stock is subject to capital losses.

Common Stock

Common stock is the fundamental ownership claim in a public corporation. Many characteristics of common stock differentiate it from other types of financial securities (e.g., bonds, mortgages, preferred stock). These include (1) discretionary dividend payments, (2) residual claim status, (3) limited liability, and (4) voting rights. These characteristics are described next.

common stock
The fundamental ownership claim in a public corporation.

Dividends. While common stockholders can potentially receive unlimited dividend payments if the firm is highly profitable, they have no special or guaranteed dividend rights. Rather, the payment and size of dividends are determined by the board of directors of the issuing firm (who are elected by the common stockholders). Further, unlike interest payments on debt, a corporation does not default if it misses a dividend payment to common stockholders. Thus, common stockholders have no legal recourse if dividends are not received, even if a company is highly profitable and chooses to use these profits to reinvest in new projects and firm growth.[2]

Another drawback with common stock dividends, from an investor's viewpoint, is that they are taxed twice—once at the firm level (at the corporate tax rate, by virtue of the fact that dividend payments are not tax deductible from the firm's profits or net earnings) and once at the personal level (at the personal income tax rate). Investors can partially avoid this double taxation effect by holding stocks in growth firms that reinvest most of their earnings to finance growth rather than paying larger dividends. Generally, earnings growth leads to stock price increases. Thus, stockholders can sell their stock for a profit and pay capital gains tax rather than ordinary income in the form of dividends. Under current tax laws, capital gains tax rates are lower than ordinary income tax rates. For example, in the early 2000s through the middle of the first decade, ordinary income tax rates ranged from 15 percent to 38.6 percent of an individual's taxable income. Long-term (a 12-month or longer investment horizon) capital gains tax rates were capped at 20 percent.

In the context of the return equation above, the reinvestment of earnings (rather than payment of dividends) affects both return components: capital gains and dividends. By reinvesting earnings (rather than paying dividends), the dividend component of returns, D_t/P_{t-1}, decreases. However, the reinvestment of earnings generally results in a relatively larger increase in the capital gains component, $(P_t - P_{t-1})/P_{t-1}$.

EXAMPLE 9–2 Payment of Dividends versus Reinvestment of Earnings

A corporation has after-(corporate) tax earnings that would allow a $2 dividend per share to be paid to its stockholders. If these dividends are paid, the firm will be unable to invest in new projects, and its stock price, currently $50 per share, probably would not change. The return to the firm's stockholders in this case is:

$$R_t = \frac{50 - 50}{50} + \frac{2}{50} = 4\%$$

Suppose a stockholder bought the stock at the beginning of the year (at $50) and sold it at the end of the year (at $50). The stockholder's ordinary income tax rate is 31 percent and capital gains tax rate is 20 percent. The return to the stockholder in this case is all in the form of ordinary income (dividends). Thus, the after-tax rate of return to the stockholder is $4\%(1 - .31) = 2.76\%$.

Alternatively, rather than pay dividends, the firm can use the earnings to invest in new projects that will increase the overall value of the firm such that the stock price will rise to

2. Eventually, of course, such profits will be paid out—in the extreme case on dissolution of the corporation.

$52 per share. The return to the firm's stockholders in this case is:

$$R_t = \frac{52 - 50}{50} + \frac{0}{50} = 4\%$$

In this case, the return to the stockholder is all in the form of capital gains, and is thus taxed at a rate of 20 percent. Thus, the after-tax rate of return to the stockholder is 4% (1 − .20) = 3.2%.

residual claim

In the event of liquidation, common stockholders have the lowest priority in terms of any cash distribution.

Residual Claim. Common stockholders have the lowest priority claim on a corporation's assets in the event of bankruptcy—they have a **residual claim.** Only after all senior claims are paid (i.e., payments owed to creditors such as the firm's employees, bond holders, the government (taxes), and preferred stockholders) are common stockholders entitled to what assets of the firm are left. The residual claim feature associated with common stock makes it riskier than bonds as an investable asset.

limited liability

No matter what financial difficulties the issuing corporation encounters, neither it nor its creditors can seek repayment from the firm's common stockholders. This implies that common stockholder losses are limited to the original amount of their investment.

Limited Liability. One of the most important characteristics of common stock is its limited liability feature. Legally, **limited liability** implies that common stockholder losses are limited to the amount of their original investment in the firm, *I* in Figure 9–2, if the company's asset value falls to less than the value of the debt it owes, point *B*. That is, the common stockholders' personal wealth held outside their ownership claims in the firm are unaffected by bankruptcy of the corporation—even if the losses of the firm exceed its total common stock ownership claims. In contrast, sole proprietorship or partnership stock interests mean the stockholders may be liable for the firm's debts out of their total private wealth holdings, *W* in Figure 9–2, if the company gets into financial difficulties and its losses exceed the stockholders ownership claims in the firm. This is the case of "unlimited" liability.

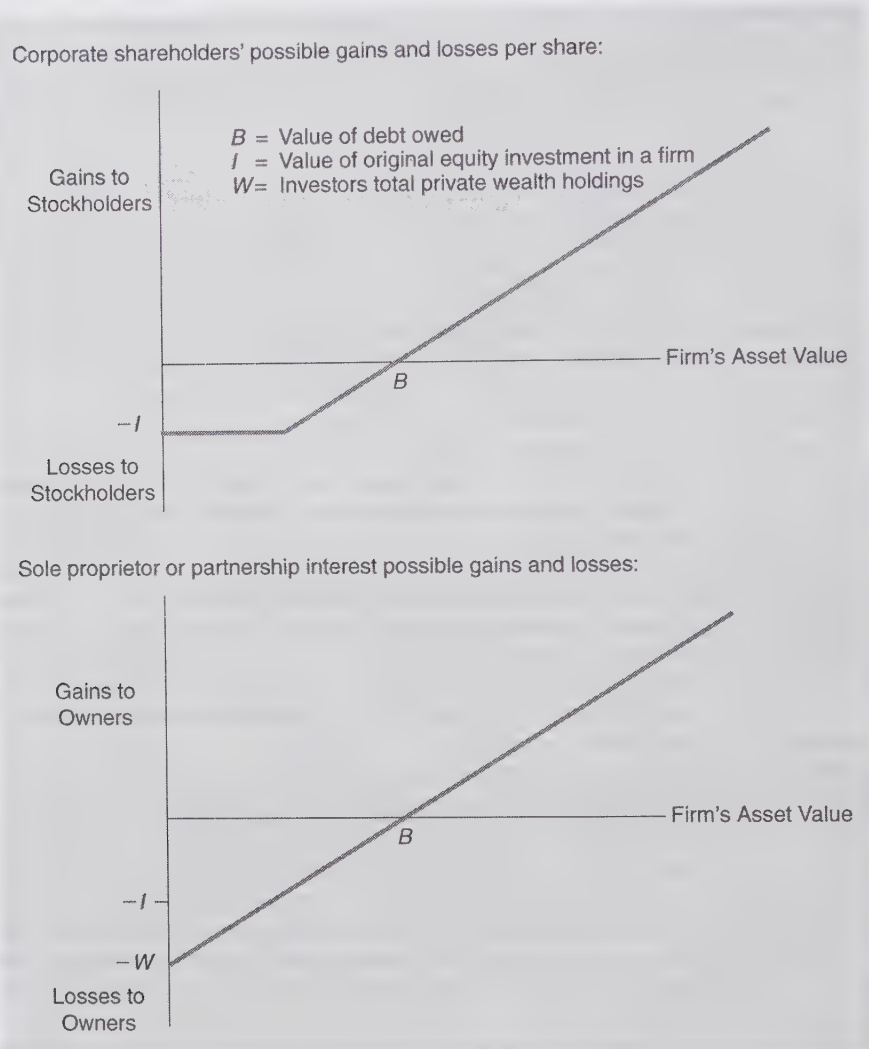
Voting Rights. A fundamental privilege assigned to common stock is voting rights. While common stockholders do not exercise control over the firm's daily activities (these activities are overseen by managers hired to act in the best interests of the firm's common stockholders and bond holders), they do exercise control over the firm's activities indirectly through the election of the board of directors. For example, in 2004 Walt Disney Co. shareholders were unhappy with many actions of the company's management, especially CEO and board chairman Michael Eisner. Problems included dropping viewer ratings at Disney-owned ABC and the breakdown of talks with Pixar Animation Studios, which had provided some of Disney's most successful movies in the past years. Eisner stepped down as chairman of the board of Disney after 43.4 percent of all shareholders voted to remove him from the board at the March 3 shareholder meeting. Six months later Eisner also announced his resignation as Disney's CEO.

dual-class firms

Two classes of common stock are outstanding, with differential voting rights assigned to each class.

The typical voting rights arrangement is to assign one vote per share of common stock. However, some corporations are organized as **dual-class firms,** in which two classes of common stock are outstanding, with different voting rights assigned to each class. For example, inferior voting rights have been assigned by (1) limiting the number of votes per share on one class relative to another (e.g., Alberto-Culver Class A shares are entitled to one-tenth vote per share, while Class B shares are entitled to one vote per share), (2) limiting the fraction of the board of directors that one class could elect relative to another (e.g., ICH Corp. allowed one vote per share on both its common and Class B stock, but common shares elect 20 percent of the board, while Class B stockholders elect 80 percent of the board), or (3) a combination of these two (e.g., American Fructose Class A shares elect 25 percent of the board and have one vote per share on all other matters, while Class B shares elect 75 percent of the board and have 10 votes per share on all other matters). To offset the reduced voting rights, inferior

FIGURE 9–2 The Limited Liability Effect



class shares are often assigned higher dividend rights. For example, no dividend is paid on the Class B common shares of Alberto Culver unless an equal or greater dividend is paid on the Class A stock.

cumulative voting

All directors up for election are voted on at the same time. The number of votes assigned to each stockholder equals the number of shares held multiplied by the number of directors to be elected.

Shareholders exercise their voting rights, electing the board of directors by casting votes at the issuing firm's annual meeting or by mailing in a proxy vote (see below). Two methods of electing a board of directors are generally used: cumulative voting and straight voting. Cumulative voting is required by law in some states (e.g., California and Illinois) and is authorized in others. With **cumulative voting,** all directors up for election, as nominated by the shareholders and selected by a committee of the board, are voted on at the same time. The number of votes assigned to each stockholder equals the number of shares held multiplied by the number of directors to be elected. A shareholder may assign all of his or her votes to a single candidate for the board or may spread them over more than one candidate. The candidates with the highest number of total votes are then elected to the board.

EXAMPLE 9-3 Cumulative Voting of a Board of Directors

Suppose a firm has 1 million shares of common stock outstanding and three directors up for election. With cumulative voting, the total number of votes available is 3,000,000 (= 1 million shares outstanding × 3 directors).

If there are four candidates for the three board positions, the three candidates with the highest number of votes will be elected to the board and the candidate with the fewest total votes will not be elected. In this example, the minimum number of votes needed to ensure election is one-fourth of the 3 million votes available, or 750,000 votes. If one candidate receives 750,000, the remaining votes together total 2,250,000. No matter how these votes are spread over the remaining three director candidates, it is mathematically impossible for *each* of the three to receive *more than* 750,000. This would require more than 3 × 750,000 votes, or more than the 2,250,000 votes that remain.

For example, if candidate 1 receives 750,000 votes and votes for the other three candidates are spread as follows:

Candidate 2 = 2 million votes
Candidate 3 = 150,000 votes
Candidate 4 = 100,000 votes

for a total of 3 million votes cast, candidates 1, 2, and 3 are elected to the board. Alternatively, votes for the other three candidates can be spread as:

Candidate 3 = 751,000 votes
Candidate 2 = 750,000 votes
Candidate 4 = 749,000 votes

Again, candidates 1, 2, and 3 are elected. Indeed, any distribution of the remaining 2,250,000 votes will ensure that candidate 1 is one of the top three vote getters and will be elected to the board.

Cumulative voting permits minority stockholders to have some real say in the election of the board of directors, since less than a majority of the votes can affect the outcome.

With straight voting, the vote on the board of directors occurs one director at a time. Thus, the number of votes eligible for each director is the number of shares outstanding. Straight voting results in a situation in which an owner of over half the voting shares can elect the entire board of directors.

proxy

A voting ballot sent by a corporation to its stockholders. When returned to the issuing firm, a proxy allows stockholders to vote by absentee ballot or authorizes representatives of the stockholders to vote on their behalf.

Proxy Votes. Most shareholders do not attend the annual meetings. Most corporations anticipate this and routinely mail proxies to their stockholders prior to the annual meeting. A completed **proxy** returned to the issuing firm allows stockholders to vote by absentee ballot or authorize representatives of the stockholders to vote on their behalf. It is estimated that, on average, less than 40 percent of the total possible votes are cast at corporate meetings. However, use of the Internet may increase this number in the future. By 2006, most U.S. firms (such as Alcoa, Federated Investors, and Morgan Stanley Dean Witter) were putting proxy statements online and allowing votes to be cast via the Internet. The entire documentation delivery process can be electronically automated with the use of services such as EquiServe or Automatic Data Processing's (ADP's) ProxyVote. Official documentation is delivered in electronic form, to shareholders, who log onto the system with a control number or personal identification number and vote for or against the resolutions presented. By the mid-2000s, the average firm offering on-line voting received almost 10 percent of its votes electronically.

Preferred Stock

Preferred stock is a hybrid security that has characteristics of both a bond and a common stock. Preferred stock is similar to common stock in that it represents an ownership interest in the issuing firm, but like a bond it pays a fixed periodic (dividend) payment. Preferred stock is senior to common stock but junior to bonds. Therefore, preferred stockholders are paid only when profits have been generated and all debt holders have been paid (but before common stockholders are paid). Like common stock, if the issuing firm does not have sufficient profits to pay the preferred stock dividends, preferred stockholders cannot force the firm into bankruptcy. Further, if the issuing firm goes bankrupt, preferred stockholders are paid their claim only after all creditors have been paid, but before common stockholders are paid.

preferred stock
A hybrid security that has characteristics of both bonds and common stock.

Dividends on preferred stock are generally fixed (paid quarterly) and are expressed either as a dollar amount or a percentage of the face or par value of the preferred stock.

EXAMPLE 9–4 Calculation of Preferred Stock Dividends

Suppose you own a preferred stock that promises to pay an annual dividend of 5 percent of the par (face) value of the stock (received in quarterly installments). If the par value of the stock is $100, the preferred stockholder will receive:

$$\text{Annual dividends} = \$100 \times .05 = \$5$$

or:

$$\text{Quarterly dividend} = \$5 \div 4 = \$1.25$$

at the end of each quarter.

Alternatively, the preferred stock could promise to pay an annual dividend of $5 per year in quarterly installments.

nonparticipating preferred stock
Preferred stock in which the dividend is fixed regardless of any increase or decrease in the issuing firm's profits.

cumulative preferred stock
Preferred stock in which missed dividend payments go into arrears and must be made up before any common stock dividends can be paid.

participating preferred stock
Preferred stock in which actual dividends paid in any year may be greater than the promised dividends.

noncumulative preferred stock
Preferred stock in which dividend payments do not go into arrears and are never paid.

Preferred stockholders generally do not have voting rights in the firm. An exception to this rule may exist if the issuing firm has missed a promised dividend payment. For example, preferred stock in Pitney Bowes, Inc., has no voting rights except when dividends are in arrears for six quarterly payments. In this case, preferred stockholders can elect one-third of the board of directors.

Typically, preferred stock is nonparticipating and cumulative. **Nonparticipating preferred stock** means that the preferred stock dividend is fixed regardless of any increase or decrease in the issuing firm's profits. **Cumulative preferred stock** means that any missed dividend payments go into arrears and *must* be made up before *any* common stock dividends can be paid.

In contrast, **participating preferred stock** means that actual dividends paid in any year may be greater than the promised dividends. In some cases, if the issuing firm has an exceptionally profitable year, preferred stockholders may receive some of the high profits in the form of an extra dividend payment. In others, the participating preferred stock pays and changes dividends along the same lines as common stock dividends. For example, RISCORP, Inc., has participating preferred stock outstanding that pays dividends equal to those on its common stock. If **preferred stock is noncumulative,** missed dividend payments do not go into arrears and are never paid. For example, G & L Realty, Inc.'s preferred stock entitles stockholders to monthly dividends based on an annual rate of $2.45 per share. If a dividend payment is missed, the dividends do not go into arrears. Noncumulative preferred stock is generally unattractive to prospective preferred stockholders. Thus, noncumulative preferred stock generally has some other special features (e.g., voting rights) to make up for this drawback.

Corporations find preferred stock beneficial as a source of funds because, unlike coupon interest on a bond issue, dividends on preferred stock can be missed without fear of bankruptcy proceedings. Additionally, preferred stock is beneficial to an issuing firm's

FIGURE 9–3 Primary Market Stock Transaction

debt holders. Funds raised through a preferred stock issue can be used by the firm to fund the purchase of assets that will produce income needed to pay debt holders before preferred stockholders can be paid.

However, preferred stock also has its drawbacks for corporations. The first drawback is that, if a preferred dividend payment is missed, new investors may be reluctant to make investments in the firm. Thus, firms are generally unable to raise any new capital until all missed dividend payments are paid on preferred stock. In addition, preferred stockholders must be paid a rate of return consistent with the risk associated with preferred stock (i.e., dividend payments may be delayed). Therefore, preferred stock may be a costlier source of funding for the issuing firm than bonds.[3]

DO YOU UNDERSTAND?

A second drawback of preferred stock from the issuing firm's viewpoint is that, unlike coupon interest paid on corporate bonds, dividends paid on preferred stock are not a tax-deductible expense—preferred dividends are paid out of after-tax earnings. This raises the cost of preferred stock relative to bonds for a firm's shareholders. Specifically, this difference in the tax treatment between coupon interest on debt and preferred stock dividends affects the net profit available to common stockholders of the firm.

PRIMARY AND SECONDARY STOCK MARKETS

Before common stock can be issued by a corporation, shares must be authorized by a majority vote of both the board of directors and the firm's existing common stockholders. Once authorized, new shares of stock are distributed to existing and new investors through a primary market sale with the help of investment banks. Once issued, the stocks are traded in secondary stock markets (such as the NYSE or NASDAQ—see below).

In this section, we examine the process involved with the primary sale of corporate stock. We also describe the secondary markets, the process by which stocks trade in these markets, and the indexes that are used to summarize secondary stock market value changes.

Primary Markets

Primary markets are markets in which corporations raise funds through *new* issues of stocks. The new stock securities are sold to initial investors (suppliers of funds) in exchange for funds (money) that the issuer (user of funds) needs. As illustrated in Figure 9–3, most primary market transactions go through investment banks (e.g., Morgan Stanley or Lehman Brothers—see Chapter 16), which serve as the intermediary between the issuing corporations (fund users) and ultimate investors (fund suppliers) in securities.

primary markets
Markets in which corporations raise funds through new issues of securities.

3. Nevertheless, the cost of preferred stock is lowered because *corporate* investors in preferred stock can shelter up to 70 percent of their dividends against taxes. Some of these tax savings may be "passed back" to the issuing firm in the form of lower required gross dividends. Thus, debt may or may not be a lower cost vehicle for the issuing firm depending on the value of this tax shield to corporate investors.

net proceeds
The guaranteed price at which the investment bank purchases the stock from the issuer.

gross proceeds
The price at which the investment bank resells the stock to investors.

underwriter's spread
The difference between the gross proceeds and the net proceeds.

syndicate
The process of distributing securities through a group of investment banks.

originating house
The lead bank in the syndicate, which negotiates with the issuing company on behalf of the syndicate.

Like the primary sale of bonds (discussed in Chapter 6), the investment bank can conduct a primary market sale of stock using a firm commitment underwriting (where the investment bank guarantees the corporation a price for newly issued securities by buying the whole issue at a fixed price from the corporate issuer) or a best efforts underwriting basis (where the underwriter does not guarantee a price to the issuer and acts more as a placing or distribution agent for a fee). In a firm commitment underwriting, the investment bank purchases the stock from the issuer for a guaranteed price (called the **net proceeds**) and resells them to investors at a higher price (called the **gross proceeds**). The difference between the gross proceeds and the net proceeds (called the **underwriter's spread**) is compensation for the expenses and risks incurred by the investment bank with the issue. In the 1990s, the underwriter's gross spread on first-time equity issues (i.e., private firms going public—the initial public offering or IPO) averaged 7.65 percent and on seasoned equity issues (i.e., publicly traded firms issuing additional shares) averaged 5.67 percent.[4] We discuss these costs in more detail in Chapter 16.

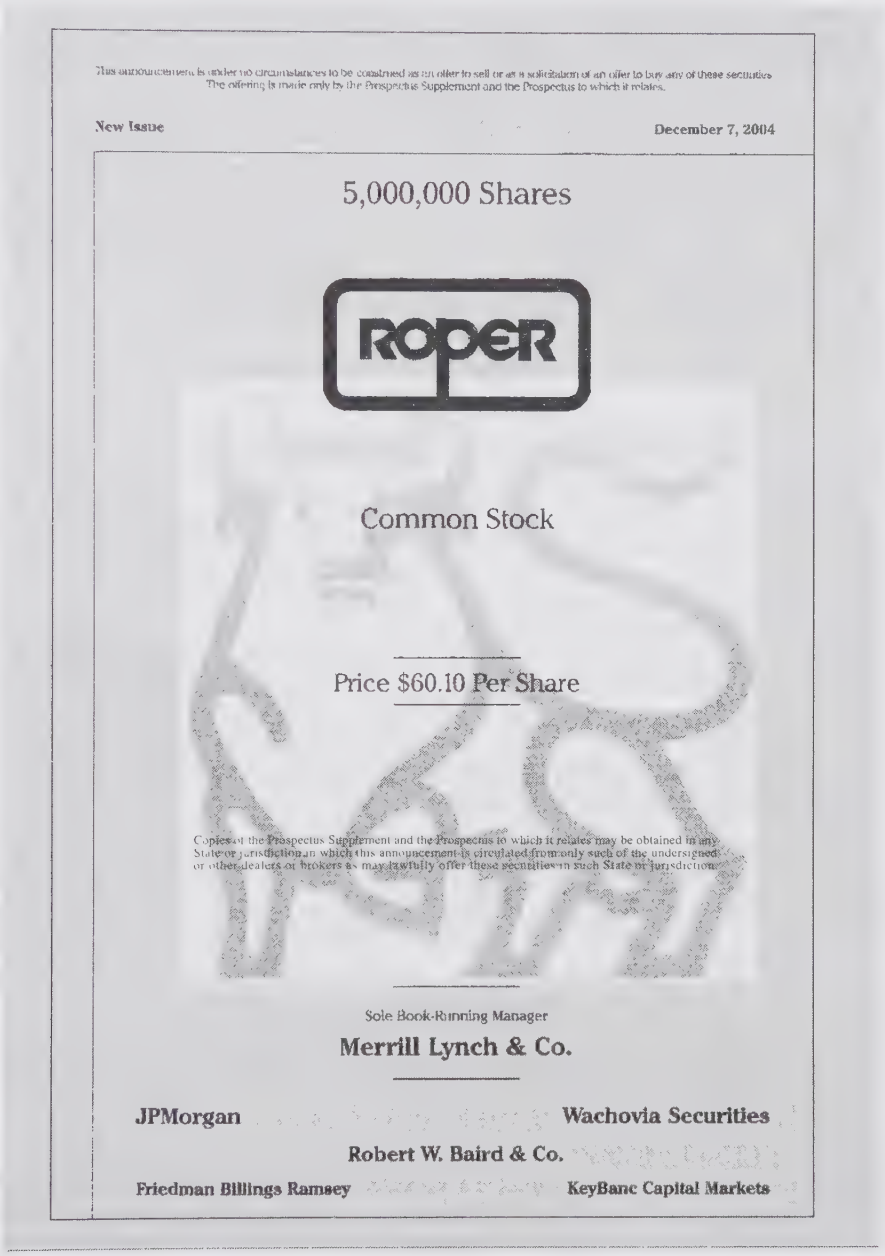
Often an investment bank will bring in a number of other investment banks to help sell and distribute a new issue—called a **syndicate.** For example, the "tombstone" in Figure 9–4 announcing the issue of 5 million shares of common stock in Roper Industries, Inc., lists the syndicate of six investment banks involved in the initial issue. The investment banks are listed according to their degree of participation in the sale of new shares. The lead bank (or "Sole Book-Running Manager") in the syndicate (Merrill Lynch), which directly negotiated with the issuing company on behalf of the syndicate, is called the **originating house.** Once an issue is arranged and its terms set, each member of the syndicate is assigned a given number of shares in the issue for which it is responsible for selling. Shares of stock issued through a syndicate of investment banks spreads the risk associated with the sale of the stock among several investment banks. A syndicate also results in a larger pool of potential outside investors, increasing the probability of a successful sale and widening the scope of the investor base.

A primary market sale may be a first-time issue by a private firm going public (i.e., allowing its equity, some of which was held privately by managers and venture capital investors, to be *publicly* traded in stock markets for the first time). These first-time issues are also referred to as initial public offerings (IPOs—see Chapter 16). For example, in 2004, Google, Inc., announced a $1.67 billion IPO of its common stock, one of the largest high-tech IPOs in history. Alternatively, a primary market sale may be a seasoned offering, in which the firm already has shares of the stock trading in the secondary markets. In both cases, the issuer receives the proceeds of the sale and the primary market investors receive the securities. Like the primary sales of corporate bond issues, corporate stocks may initially be issued through either a public sale (where the stock issue is offered to the general investing public) or a private placement (where stock is sold privately to a limited number of large investors).

In recent years public confidence in the integrity of the IPO process has eroded significantly. Investigations have revealed that certain underwriters of IPOs have engaged in misconduct contrary to the best interests of investors and the markets. Among the most harmful practices giving rise to public concerns are "spinning" (in which certain underwriters allocate "hot" IPO issues to directors and/or executives of potential investment banking clients in exchange for investment banking business) and "biased" recommendations by research analysts (whose compensation is tied to the success of their firms' investment banking business). This culminated in the spring of 2003 with an agreement between securities regulators and 10 of the nation's largest securities firms, in which they agreed to pay a record $1.4 billion in penalties to settle charges involving investor abuses. The settlement centered on civil charges that securities firms routinely issued overly optimistic stock research to investors to gain favor with corporate clients and win their investment banking business.

4. See A. Gande, M. Puri, and A. Saunders, "Bank Entry, Competition and the Market for Corporate Securities Underwriting," *Journal of Financial Economics,* 1999, pp. 165–195; and I. Lee, S. Lockhead, J. Ritter, and Q. Zhao, "The Cost of Raising Capital," *Journal of Financial Research,* Spring 1996, pp. 59–74.

FIGURE 9–4 Tombstone Announcing the Issuance of Common Stock



Source: Roper, Inc., prospectus.

The agreement also settled charges that some major firms improperly allocated IPO shares to corporate executives to win investment banking business from their firms. The agreement forces brokerage companies to make structural changes in the way they handle research—preventing, for example, analysts from attending certain meetings relating to investment banking.[5]

5. Within days of this agreement, however, Bears Stearns, one of the 10 firms party to the settlement, was accused of using its analysts to promote a new stock offering.

preemptive rights
A right of existing stockholders in which new shares must be offered to existing shareholders first in such a way that they can maintain their proportional ownership in the corporation.

Corporate law in some states, and some corporate charters, gives shareholders **preemptive rights** to the new shares of stock when they are issued. This means that before a seasoned offering of stock can be sold to outsiders, the new shares must first be offered to existing shareholders in such a way that they can maintain their proportional ownership in the corporation. A "rights offering" generally allows existing stockholders to purchase shares at a price slightly below the market price. Stockholders can then exercise their rights (buying the allotted shares in the new stock) or sell them. The result can be a low-cost distribution of new shares for a firm (i.e., the issuing firm avoids the expense of an underwritten offering).

EXAMPLE 9–5 Calculation of Shares Purchased through a Rights Offering

Suppose you own 1,000 shares of common stock in a firm with 1 million total shares outstanding. The firm announces its plan to sell an additional 500,000 shares through a rights offering. Thus, each shareholder will be sent 0.5 right for each share of stock owned. One right can then be exchanged for one share of common stock in the new issue.

Your current ownership interest is 0.1 percent (1,000/1 million) prior to the rights offering and you receive 500 rights (1,000 × 0.5) allowing you to purchase 500 of the new shares. If you exercise your rights (buying the 500 shares), your ownership interest in the firm after the rights offering is still 0.1 percent ((1,000 + 500)/(1 million + 500,000)). Thus, the rights offering ensures that every investor can maintain his or her fractional ownership interest in the firm.

Suppose the market value of the common stock is $40 before the rights offering, or the total market value of the firm is $40 million ($40 × 1 million), and the 500,000 new shares are offered to current stockholders at a 10 percent discount, or for $36 per share. The firm receives $18 million. The market value of the firm after the rights offering is $58 million (the original $40 million plus the $18 million from the new shares), or $38.67 per share ($58 million ÷ 1.5 million).

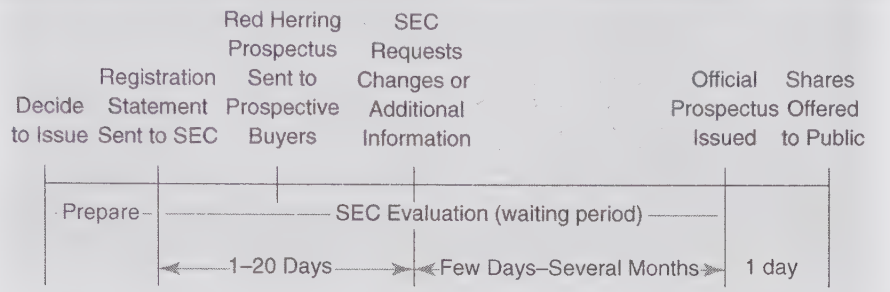
Your 1,000 shares are worth $40,000 ($40 × 1,000) before the rights offering, and you can purchase 500 additional shares for $18,000 ($36 × 500). Thus, your total investment in the firm after the rights offering is $58,000, or $38.67 per share ($58,000 ÷ 1,500).

Suppose you decide not to exercise your preemptive right. Since each right allows a stockholder to buy a new share for $36 per share when the shares are worth $38.67, the value of one right should be $2.67. Should you sell your rights rather than exercise them, you maintain your original 1,000 shares of stock. These have a value after the rights offering of $38,667 (1,000 × 38.67). You could also sell your rights to other investors for $1,333 (500 × $2.67). As a result, you have a total wealth level of $40,000—you have lost no wealth.

In 2004, PriceSmart announced a rights offering to its common stockholders intended to raise $110 million in new stock at a subscription price of $7.00 per share—that is, to issue 15.787 million new shares of common stock. Prior to the rights offering, PriceSmart had 10,524,000 shares of common stock outstanding, and each shareholder received 1 right for each share of stock owned. PriceSmart common stock traded between $7.25 and $9.25 per share during the period of the rights offering. Thus, right holders could purchase new shares in PriceSmart at a discount of between $0.25 and $2.25 from the market price of the stock. These rights could be sold by PriceSmart common stockholders to other investors. Rights are similar to options in that they give the holder the option, but not the obligation, to buy the stock at a fixed price (see Chapter 10). The rights holder has the option of buying the new shares at the stated price, selling the rights to other investors, or letting the rights expire at the end of the offering period unused.

In a public sale of stock, once the issuing firm and the investment bank have agreed on the details of the stock issue, the investment bank must get SEC approval in accordance

FIGURE 9–5 Getting Shares of Stock to the Investing Public



with the Securities and Exchange Act of 1934. Registration of a stock can be a lengthy process. We illustrate the process in Figure 9–5. The process starts with the preparation of the registration statement to be filed with the SEC. The registration statement includes information on the nature of the issuer's business, the key provisions and features of the security to be issued, the risks involved with the security, and background on the management. The focus of the registration statement is on full information disclosure about the firm and the securities issued to the public at large. At the same time that the issuer and its investment bank prepare the registration statement to be filed with the SEC, they prepare a preliminary version of the public offering's prospectus called the **red herring prospectus.** The red herring prospectus is similar to the registration statement but is distributed to potential equity buyers. It is a preliminary version of the official or final prospectus that will be printed upon SEC registration of the issue.

red herring prospectus

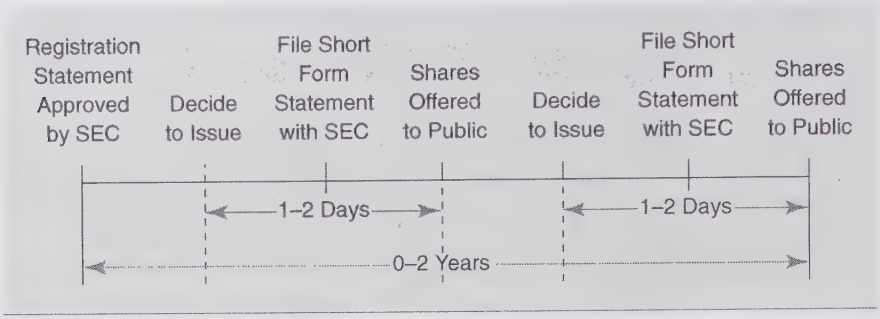
A preliminary version of the prospectus describing a new security issue distributed to potential buyers prior to the security's registration.

After submission of the registration statement, the SEC has 20 days to request additional information or changes to the registration statement. It generally takes about 20 days for the SEC to approve a new security issue. First-time or infrequent issuers can sometimes wait up to several months for SEC registration, especially if the SEC keeps requesting additional information and revised red herring prospectuses. This period of review is called the waiting period. However, companies that know the registration process well can generally obtain registration in a few days.

Once the SEC is satisfied with the registration statement, it registers the issue. At this point, the issuer (along with its investment bankers) sets the final selling price on the shares, prints the official prospectus describing the issue, and sends it to all potential buyers of the issue. Upon issuance of the prospectus (generally the day following SEC registration), the shares can be sold.

The period of time between the company's filing of the registration statement with the SEC and the selling of shares is referred to at the "quiet period." Historically, the issuing company could send no written communication to the public during the quiet period other than information regarding the normal course of business. Once a company registered with the SEC for a public offering it could engage in oral communication only. That meant the company executives could go on so-called roadshows to solicit investors or have brokers call potential investors to discuss the offering. But they could not provide any written communication, such as faxes or letters, or give interviews about the company's offering. These rules, adopted in 1933, did not foresee new technology, such as the Internet and e-mail. Moreover, these outdated rules may have hurt investors by giving them too little information. Thus, in October 2004, the SEC proposed a rule change giving large companies (market capitalization of at least $700 million or with at least $1 billion in debt) more freedom to communicate with investors during the quiet period. Specifically, these companies would be allowed to communicate with investors at any time prior to a public offering through

FIGURE 9–6 Getting Shelf Registrations to the Investing Public



e-mail, letters, even TV ads as long as the information is also filed with the SEC. Such communication was previously prohibited.

Further, in January 2005, the SEC proposed an overhaul in the issuing process for stock IPOs that would facilitate greater use of the Internet to disseminate information to the markets. Although the use of the Internet was not forbidden by the SEC, current rules put issuers in legal jeopardy if they depart from the formal written prospectuses and face-to-face roadshows. Under the new proposed rules, the SEC would formally allow Internet broadcasts of roadshows. These online broadcasts would be open to all investors, not just the chosen few invited to previously closed-door presentations. In fact, the proposed rules encourage broad Internet roadshow dissemination, giving investment banks that open them to the public a break from certain filing requirements. Furthermore, issuers and investment bankers would be able to forgo sending final offering prospectuses to IPO investors. Under the SEC's proposal, issuers would still have to distribute preliminary (red herring) prospectuses to potential investors. But realizing that most investors get offering documents electronically anyway, the SEC wanted to allow issuers to e-mail investors when a stock price is set, tell them their allocations, and point out that a formal prospectus would soon be filed with the SEC.

www.sec.gov

In order to reduce the time and cost of registration, yet still protect the public by requiring issuers to disclose information about the firm and the security to be issued, the SEC passed a rule in 1982 allowing for "shelf registration." As illustrated in Figure 9–6, **shelf registration** allows firms that plan to offer multiple issues of stock over a two-year period to submit one registration statement as described above (called a master registration statement). The registration statement summarizes the firm's financing plans for the two-year period. Thus, the securities are shelved for up to two years until the firm is ready to issue them. Once the issuer and its investment bank decide to issue shares during the two-year shelf registration period, they prepare and file a short form statement with the SEC. Upon SEC approval, the shares can be priced and offered to the public usually within one or two days of deciding to take the shares "off the shelf."

shelf registration
Allows firms that plan to offer multiple issues of stock over a two-year period to submit one registration statement summarizing the firm's financing plans for the period.

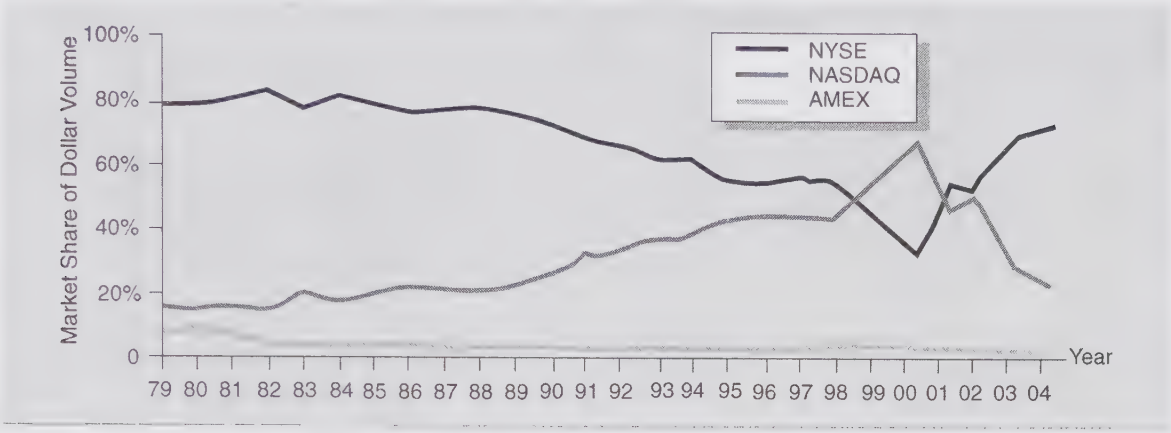
Thus, shelf registration allows firms to get stocks onto the market quickly (e.g., in one or two days) if they feel conditions (especially the price they can get for the new stock) are right, without the time lag generally associated with full SEC registration. For example, in January 2005, Array BioPharma, Inc., announced a public offering of 6 million shares of its common stock under its shelf registration filed with the SEC. UBS Investment Bank led the underwriting of shares that were sold just days after this announcement.

secondary stock markets
The markets in which stocks, once issued, are traded—rebought and resold.

4 Secondary Markets

Secondary stock markets are the markets in which stocks, once issued, are traded—that is, bought and sold by investors. The New York Stock Exchange

FIGURE 9–7 Dollar Volume of Trading on the NYSE, AMEX, and NASDAQ



Source: NASDAQ Web site, various dates. **www.nasdaq.com**

(NYSE) and the National Association of Securities Dealers Automated Quotation (NASDAQ) system are well-known examples of secondary markets in stocks.[6]

When a transaction occurs in a secondary stock market, funds are exchanged, usually with the help of a securities broker or firm acting as an intermediary between the buyer and the seller of the stock. The original issuer of the stock is not involved in this transfer of the stocks or the funds. In this section, we look at the major secondary stock markets, the process by which a trade occurs, and the major stock market indexes.

www.nyse.com

www.amex.com

www.nasdaq.com

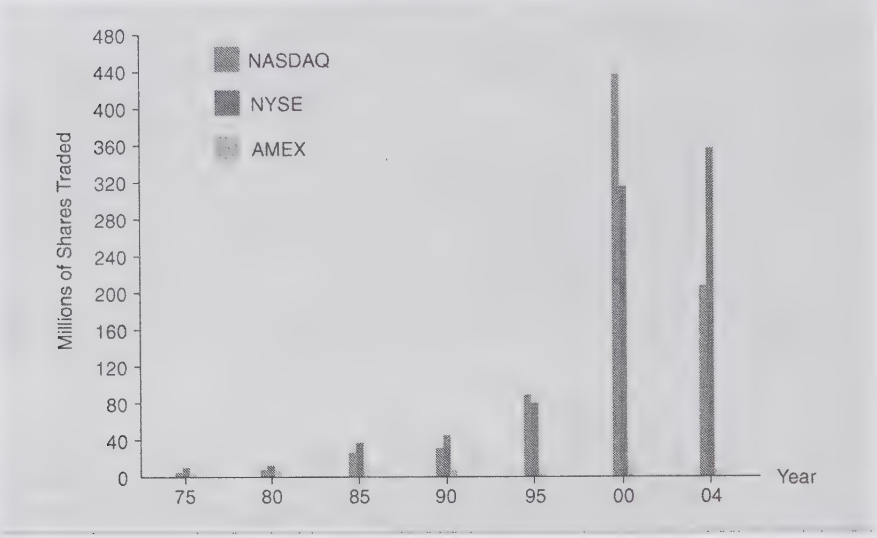
Stock Exchanges. The three major U.S. stock markets are the New York Stock Exchange (NYSE), the National Association of Securities Dealers Automated Quotation (NASDAQ) system, and the American Stock Exchange (AMEX). Figures 9–7, 9–8, and 9–9 present data comparing the three stock markets. Figure 9–7 shows dollar volume of trading in each market from 1979 through 2004; Figure 9–8 shows share volume in each market from 1975 through 2004; and Figure 9–9 shows the number of companies listed in each market from 1975 through 2004. Obvious from these trading volume and listing figures is that while the NYSE is the premier stock market and the NASDAQ is a strong second market, activity on the AMEX is dropping on all accounts. Other smaller stock exchanges include the Pacific Stock Exchange, the Chicago Stock Exchange, the Philadelphia Stock Exchange, the Boston Stock Exchange, and the Cincinnati Stock Exchange. These account for no more than 5 percent of daily U.S. stock market volume.

Note that the total market value of shares listed in these markets was over $21 trillion at the end of 2004. Although this market looks huge, this represents the value of all stocks ever issued by firms that did not go bankrupt. For example, of this total market value, just over $115 billion of new shares was issued in 2004 (see Table 9–1).

The New York Stock Exchange. Worldwide, the New York Stock Exchange (NYSE) is the most well known of all the organized exchanges in the United States. Over 2,700 different stocks are listed and traded on the NYSE. Table 9–2 summarizes the market activity in the NYSE (as well as the AMEX and NASDAQ) as of the end of 2004. The dollar volume of trading in average daily 2004 was $45.9 billion on 1.5 billion shares traded.

6. On October 30, 1998, the National Association of Securities Dealers, Inc. (NASD) (which at the time owned the NASDAQ market, the world's first electronic stock market) and the American Stock Exchange (AMEX), the nation's second largest floor-based exchange, merged to form the Nasdaq-Amex Market Group. At the time, the two markets shared Web sites, made joint press statements, and collaborated on marketing plans. NASDAQ was also to help develop state-of-the-art technology for AMEX. However, after less than a year there was a clash of cultures between the two markets. In 2000, the NASD sold its ownership of NASDAQ, maintaining its ownership of AMEX. In March 2002, the NASD unsuccessfully approached the NYSE asking it to consider the purchase of AMEX. Unable to find an outside buyer, in 2005 AMEX members purchased the exchange from the NASD.

FIGURE 9–8 Annual Share Volume of Trading on the NYSE, AMEX, and NASDAQ
(in millions of shares traded)



Source: NYSE, NASDAQ, and AMEX Web sites, various dates. **www.nyse.com; www.nasdaq.com; www.amex.com**

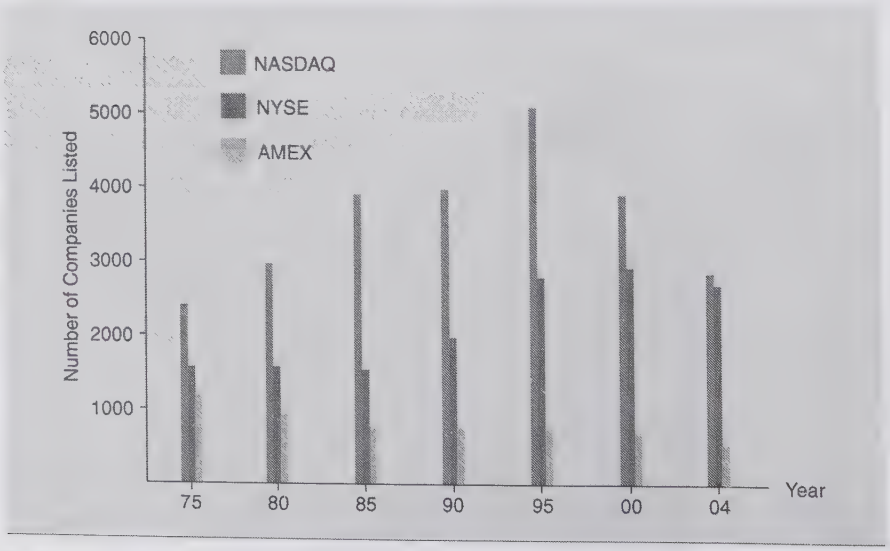
5

The Trading Process. All transactions occurring on the NYSE occur at a specific place on the floor of the exchange (called a **trading post**)—see Figure 9–10. Each stock is assigned a special market maker (a **specialist**). The market maker is like a monopolist with the power to arrange the market for the stock. In return, the specialist has an affirmative obligation to stabilize the order flow and prices for the stock in times when the market becomes turbulent (e.g., when there is a large imbalance of sell orders, the specialist has an obligation to buy the stock to stabilize the price).

trading post
A specific place on the floor of the exchange where transactions on the NYSE occur.

specialists
Exchange members who have an obligation to keep the market going, maintaining liquidity in their assigned stock at all times.

FIGURE 9–9 Number of Companies Listed on NYSE, AMEX, and NASDAQ



Source: NYSE, NASDAQ, and AMEX Web sites, various dates. **www.nyse.com; www.nasdaq.com; www.amex.com**

TABLE 9–2 Market Activity on the NYSE, AMEX, and NASDAQ

	NYSE	AMEX	NASDAQ
Average daily share volume (in millions)	1,494	69	1,073
Average daily dollar volume (in millions)	$45,900	$2,477	$20,894
Market value (month end) (in billions)	$18,000	$411	$2,990
Number of companies (month end)	2,758	655	3,293
Number of issues (month end)	3,594	807	3,503
Average price per shares traded	$31.51	$36.14	$19.46

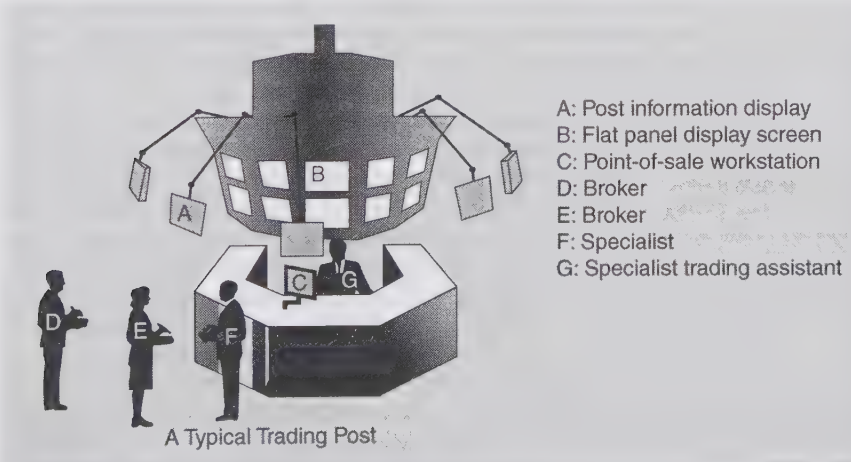
Source: NYSE, NASDAQ, and AMEX Web sites. **www.nyse.com; www.nasdaq.com; www.amex.com**

Because of the large amount of capital needed to serve the market-making function, specialists often organize themselves as firms (e.g., Le Branche & Co., Spear, Leeds and Kellogg Specialists, Inc.). Specialist firms on the NYSE range in size from 2 to over 20 members. Specialist firms may be designated to serve as the market maker for more than one stock. However, only one specialist is assigned to each stock listed on the exchange. In general, because specialists are obligated to establish the fair market price of a stock and must even occasionally step in and stabilize a stock's price, underwriters/investment banks (responsible for getting the best available price for their customers' new issues) are rarely allowed by the Exchange to become specialists.

Three types of transactions can occur at a given post: (1) brokers trade on behalf of customers at the "market" price (market order); (2) limit orders are left with a specialist to be executed; and (3) specialists transact for their own account. These types of trades are discussed in more detail below. As of December 2004, 323 firms had representatives "seated" on the floor of the NYSE (230 of the total 1,366 seats dealt with trades sent from the public) at a price of $1.0 million per seat, a nine-year low for a NYSE seat. In 1999 during the stock market boom, the price of a seat rose to $2.6 million. By mid-2005, the price of a seat had risen to $3.0 million.

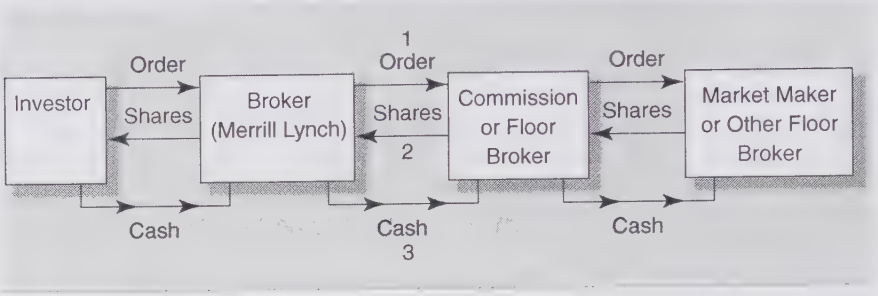
Generally, as illustrated in Figure 9–11, when individuals want to transact on the NYSE, they contact their broker (such as Merrill Lynch). The broker then sends the order to its representative at the exchange (called a commission broker) or to a floor broker (working for themselves) to conduct the trade with the appropriate specialist or market

FIGURE 9–10 New York Stock Exchange Trading Post



Source: The New York Stock Exchange Web site, August 1999. **www.nyse.com**

FIGURE 9–11 Purchase of a Stock on the NYSE



maker in the stock. Large brokerage firms generally own several "seats" on the floor filled by their commission brokers trading orders for the firm's clients or its own accounts. One of the specialist's jobs is to execute orders for floor and commission brokers. However, these brokers can transact at a post with others without specialist participation. Specialists participate in only about 10 percent of all shares traded. Also, orders are increasingly coming from the public using online (Internet) trading, bypassing the commission broker and going directly to the floor broker (see Chapter 16).

Once the transaction is completed (generally in less than 15 minutes), the investor's broker is contacted and the trade is confirmed. Generally, the transaction is settled in three days (so-called settlement at T + 3)—that is, the investor has three days to pay for the stock and the floor or commission broker has three days to deliver the stock to the investor's broker.

market order

An order to transact at the best price available when the order reaches the post.

The vast majority of orders sent to floor or commission brokers are of two types: market orders or limit orders. A **market order** is an order for the broker and the market specialist to transact at the best price available when the order reaches the post. The floor or commission broker will go to the post and conduct the trade. Before 2005, the best price meant that brokers were required to enter only their very best bid and offer prices for a stock at a specified time into a public electronic database of stock quotes. In 2004, the SEC proposed an overhaul of the rules that radically altered the way the best price would be established: Brokers seeking the best price on a trade would have to enter all their bids and offers for a stock into the public database. This would enable other brokers who want to fill orders, including large block trades, to "sweep" all markets for the best price and to simultaneously execute trades in the same stock across different markets. The so-called intermarket sweep would allow brokers to pick off the best prices among all accessible quotes. So a customer (like an individual investor) who wants to buy shares of stock could get chunks of that order filled at the best price across various markets. The change introduces more computerization into the trading process and reduces the amount of NYSE trading conducted via the auction system overseen by specialist firms.

limit order

An order to transact at a specified price.

A **limit order** is an order to transact only at a specified price (the limit price). When a floor or commission broker receives a limit order, he or she will stand by the post with the order if the current price is near the limit price. When the current price is not near the limit price, a floor or commission broker does not want to stand at the post for hours (and even days) waiting for the current price to equal the limit price on this single limit order. In this case, the floor broker enters the limit order on the order book of the specialist at the post. The specialist, who is at the post at all times when the market is open, will monitor the current price of the stock and conduct the trade when, and if, it equals the limit price. Some limit orders are submitted with time limits. If the order is not filled by the time date for expiration, it is deleted from the market maker's book.[7] The third type of trade is that of a specialist trading for his or her own account.

7. Similar to a limit order, a stop order is an order to sell a stock when its price falls to a particular point.

FIGURE 9–12 Price on a Market Order versus a Limit Order

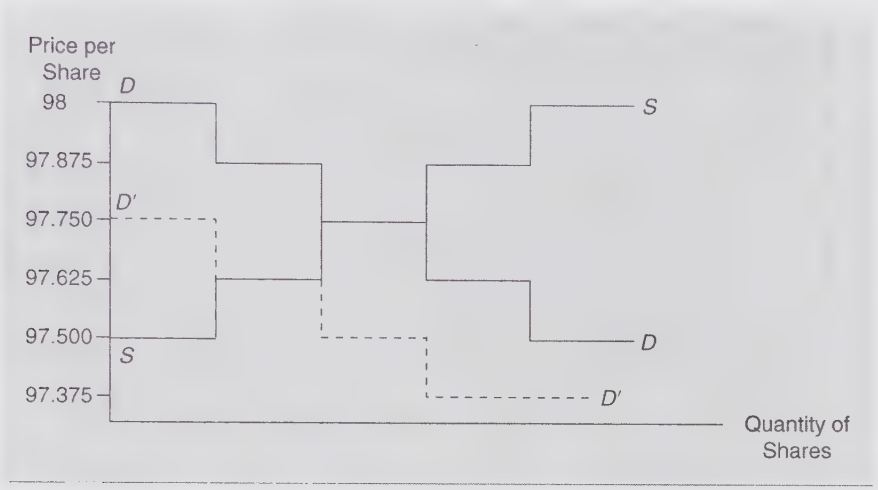


Figure 9–12 illustrates the link between a market order and a limit order. When a market order is placed, the transaction occurs at the current market price, $97.75 per share, determined by the intersection of investors' aggregate supply (*S*) of and demand (*D*) for the stock. If the limit order price (e.g., $97.625 per share) differs from the current market price, the order is placed on the specialist's book. If supply and/or demand conditions change (e.g., the demand curve in Figure 9–12 falls to *D′*) such that the market price falls to $97.625 per share, the specialist completes the limit order and notifies the floor broker who submitted the order.

Program Trading. The NYSE has defined program trading as the simultaneous buying and selling of a portfolio of at least 15 different stocks valued at more than $1 million, using computer programs to initiate the trades. For example, program trading can be used to create portfolio insurance. A program trader can take a long position in a portfolio of stocks and a short position in a stock index futures contract (see Chapter 10). Should the market value of the stock portfolio fall, these losses are partly offset by the position in the futures contract. The timing of these trades is determined by the computer program.

Program trading has been criticized for its impact on stock market prices and increased volatility. For example, on Tuesday, April 25, 1997, the Dow Jones Industrial Average (DJIA), discussed below, rose 173.38 points, at the time the biggest price increase in the 1990s. That day saw no significant new economic information and, while several companies announced earnings results that were better than expected, these announcements were not significant enough on their own to explain the large price increase. Rather, it was computer-driven program trading that was given the credit for the large change in the index. On June 27, 1994, a single program trade executed on the NYSE pushed the DJIA down almost 30 points. The program trade took place around noon on a trading day that saw less then 300 million shares traded. This trade was followed by two other sell orders via program trades. Together, the three program trades drove the DJIA down 55 points before ending the day down 34 points to 3708. Critics argue that whenever the market has a disturbance and investors are hesitant to trade, program traders accelerate activity and have a significant impact on stock market values.

As a result of the potential for increased volatility created by program trading, the New York Stock Exchange introduced trading curbs (or circuit breakers) on trading. Trading curbs are limitations placed on trading when the DJIA falls significantly. For example in the first quarter of 2005, a 1,050-point drop in the DJIA before 2 p.m. would halt trading for one hour or for 30 minutes if the drop occurred between 2 and 2:30 p.m.; and a drop occurring at 2:30 p.m. or later would have no effect. A 2,150-point drop in the DJIA

before 1 p.m. would halt trading for two hours; for one hour if the drop occurs between 1 and 2 p.m.; and the remainder of the day if the drop occurs at 2:30 p.m. or later. A 3,200-point drop in the DJIA would halt trading for the remainder of the day regardless of when the decline occurs.

In the late 1980s, about 15 million shares were traded per day on the NYSE as program trades. At the end of 2004, average daily volume of program trading was 811.5 million shares (44.9 percent of the total average daily volume). The most active program traders are investment banks (e.g., UBS, Morgan Stanley) conducting trades for their own accounts or those of their customers (e.g., insurance companies, hedge funds, pension funds). Much of this program trading involves index funds (e.g., Vanguard's 500 Index Fund, which seeks to replicate the S&P 500 Index—see below) and futures contracts on various indexes (e.g., S&P 500 Index futures—see Chapter 10). Investment in these index funds grew in the 1980s and 1990s as a result of the relatively poor performance (in terms of returns) of specialized mutual funds (see Chapter 17) and the strong performance in the major indexes.

Stock Market Quote. Table 9–3 presents a small part of a NYSE stock quote list from *The Wall Street Journal* summarizing trading on Thursday, December 30, 2004. Column 1 lists the year-to-date percentage change in the stock price (e.g., Amerisource Berger Corporation's stock price increased 4.3 percent between January 1 and December 30, 2004). Columns 2 and 3 of the stock quote show the high and low closing price on the listed stocks over the previous (from December 30, 2004) 52 weeks. Share prices and price changes are recorded in cents. As of September 2000, the NYSE started phasing in decimalization of stock quotes in which equity securities prices were quoted in a decimal format—$64.50, with increments of one cent per share. Column 4 lists the name of the corporation and its ticker symbol. When trades are recorded on a stock, the ticker symbol is used rather than the company name. Column 5, labeled DIV, is the annual dividend per share based on the most recent dividend payment (e.g., Amerisource Berger Corp. paid dividends of $0.10 per share on its common stock during the 12 months preceding December 30, 2004). Column 6, labeled YLD %, is the dividend yield on the stock (equal to the annual dividends per year divided by the closing stock price (e.g., for Amerisource Berger Corp., .10 ÷ 58.54 = 0.2 percent)). Column 7 is the firm's P/E ratio—the ratio of the company's closing price to earnings per share over the previous year (e.g., Amerisource Berger Corp.'s P/E ratio is reported to be 14; Amerisource Berger's price—the numerator of the P/E ratio—is reported as 58.54; thus, Amerisource Berger Corp.'s earnings per share—the denominator of the P/E ratio—over the period December 2003 through December 2004 must have been $4.18 per share: $E = P \div P/E = \$58.54 \div 14$). The P/E ratio is used by traders as an indicator of the relative value of the stock. High P/E ratio stocks reflect the market's expectation of growth in earnings. Should earnings expectations fail to materialize, these stocks will see a price drop. Low P/E ratio stocks generally have low earnings growth expectations. Column 8, VOL 100s, lists the day's trading volume in 100s of shares (e.g., 1,566,900 shares of Amerisource Berger Corp. traded on December 30, 2004). Normally, shares are traded in "round" lots of 100. Column 9, CLOSE, is the price on the last transaction to occur (the close) on December 30, 2004. Finally, Column 10, NET CHG, is the change in the closing price from the previous day's closing price (in cents).

www.amex.com

The American Stock Exchange. The American Stock Exchange (AMEX), located in New York, generally lists stocks of smaller firms that are of national interest. It is organized as a floor broker-specialist market-maker system like the NYSE. As of December 2004, stocks of 807 issues were trading on the AMEX. Figures 9–7 through 9–9 show the diminishing size and importance of the AMEX. Average daily share volume on the AMEX in December 2004 (69 million shares), as seen in Table 9–2, was approximately 4 percent of the shares traded on the NYSE. Average daily dollar volume on the AMEX in December 2004 ($2,477 million) was 5 percent of that on the NYSE.

TABLE 9–3 Stock Market Quote, December 30, 2004

(1) (2) (3) (4) (5)(6)(7)(8) (9) (10)

YTD %CHG	52-WEEK HI	52-WEEK LO	STOCK (SYM)	DIV	YLD %	PE	VOL 100s	CLOSE	NET CHG
4.3	64.50	49.74	AmerisrcBrg ABC	.10	.2	14	15669	58.54	0.54
10.7	40 47	27.77	AmeronInt AMN	.80	2.1	42	148	38.41	–0.32
29 9	45.99	34.63	AmerUsGp A AMH	.40	.9	11	1675	45.44	–0.24
47.7	36.23	27.99	Ametek AME s	.24	.7	..	3761	35.65	–0.03
–7.2	21.56	10.70	AMN Hithcare AHS		..	28	564	15.92	–0.03
7.2	14.51	12.50	AmpcoPgh AP	.40	2.7	98	32	14.66	0.16
14.6	37.52	27.90	Amphenol APH s		..	22	1619	36.64	0.04
46.5	24	15.27	AMREP AXR	.40e	1.7	11	22	23.20	–0.38
6.4	27	21.91	AmSoBcp ASO	1.00f	3.8	15	4596	26.08	0.14
–15.8	17.33	9.62	Amvescap AVZ	.33e	2.7	..	333	12.41	0.12
27.1	71.55	48	AnadrkPete APC	.56	.9	11	10658	64.85	–0.27
–18.9	52.37	31.36	AnalogDevic ADI	.24	.6	25	20925	37.03	0.39
23.6	27.77	21.10	◆AngelicaAGL	.44	1.6	49	138	27.19	–0.03
–22.5	48.25	29.91	◆AngGldAsh ADS AU	.75e	2.1	..	6689	36.17	–0.33
–3.4	54.74	49.42	AnheuserB BUD	.98	1.8	19	13006	50.87	0.21
47.5	39.35	24.28	AnixterInti AXE	1.50e	4.1	23	2226	36.20	–0.10
7 7	21.27	15.94	AnnalyMtg NLY	2.00	10.1	10	10352	19.82	0.12
–18.1	31.43	19.98	AnnTaylor ANN s		..	14	6936	21.30	–0.02
17 7	42.39	27.01	AnteroInti ANT		..	31	2402	42.43	0.28
11.4	13.10	10.38	◆AnthracitCap AHR	1.12	9.1	28	1388	12.33	–0.05
–23.5	14.28	10.01	AnworthMtg ANH	1.08	10.1	8	3455	10.65	..
–2.3	29.44	18.15	AON Cp AOC	.60	2.5	11	6078	23.64	..
24.6	55.16	36.79	◆ApacheCp APA s	.32	.6	12	9437	50.54	–0.07
12.6	38.80	26.45	◆ApartmInv AIV	2.40	6.2	33	3645	38.83	0.03
–28.0	14.30	3.80	Applica APN		..	dd	3881	5.47	0.12
1.3	24.44	17.76	AppBioApplera ABI	.17	.8	23	5064	20.98	0.13
72.4	32	13.13	AppldMatTch AMTs	.37	1.4	21	2560	27.42	–0.16
17.3	34.95	26.25	AprilaHithc AHG		..	15	3315	33.40	–0.38
37.1	54.89	36.71	AptarGp ATR	.60	1.1	22	303	53.47	0.10
10.9	24.11	18.90	AquaAmer WTR	.52f	2.1	30	1857	24.51	0.51
9.7	4.86	2.25	Aquila ILA		..	dd	7340	3.72	0.01
7.6	39.61	28.35	Aracruz ADS ARA	2.18e	5.8	20	736	37.70	0.05
–3.5	29.35	21.18	Aramark RMK	.22f	.8	19	3797	26.47	–0.10
–5.8	45.90	31.29	Arbitron ARB		..	21	919	39.30	–0.21
20.7	24.56	18.05	ArborRltyTr ABR n	.78e	3.2	..	341	24.75	0.21
11.7	30.87	23.41	ArchChem ARJ	.80	2.8	22	366	28.65	0.18
11.6	39	26.20	ArchCoal ACI	.32	.9	19	6784	34.80	–0.31
46.9	22.31	14.90	ArcherDan ADM	.30	1.3	24	12583	22.36	0.43
38.5	38.25	25.67	ArcsineSmt ASN	1.72a	4.6	17	9536	37.74	0.09
22.3	37.82	25.85	◆ArdenRlty ARI	2.02	5.4	45	2225	37.12	0.07

How to Read the Stock Tables

The following explanations apply to the New York and American exchange listed issues and the Nasdaq Stock Market. NYSE and Amex prices are composite quotations that include trades on the Chicago, Pacific, Philadelphia, Boston and National (NSX) exchanges and reported by the National Association of Securities Dealers.

Boldfaced quotations highlight those issues whose price changed by 5% or more if their previous closing price was $2 or higher.

Underlined quotations are those stocks with large changes in volume, per exchange, compared with the issue's average trading volume. The calculation includes common stocks of $5 a share or more with an average volume over 65 trading days of at least 5,000 shares. The underlined quotations are for the 40 largest volume percentage leaders on the NYSE and the Nasdaq National Market. It includes the 20 largest volume percentage gainers on the Amex.

YTD percentage change reflects the stock price percentage change for the calendar year to date adjusted for stock splits and dividends over 10%.

The 52-week high and low columns show the highest and lowest price of the issue during the preceding 52 weeks plus the current week, but not the latest trading day. These ranges are adjusted to reflect stock payouts of 1% or more, and cash dividends or other distributions of 10% or more.

Dividend/Distribution rates, unless noted, are annual disbursements based on the last monthly, quarterly, semiannual, or annual declaration. Special or extra dividends or distributions, including return of capital, special situations or payments not designated as regular are identified by footnotes.

Yield is defined as the dividends or other distributions paid by a company on its securities, expressed as a percentage of price.

The P/E ratio is determined by dividing the closing market price by the company's diluted per-share earnings, as available, for the most recent four quarters. Charges and other adjustments usually are excluded when they qualify as extraordinary items under generally accepted accounting rules.

Sales figures are the unofficial daily total of shares traded, quoted in hundreds (two zeros omitted; f-four zeros omitted.)

Exchange ticker symbols are shown for all New York and American exchange common stocks, and Dow Jones News/Retrieval symbols are listed for Class A and Class B shares listed on both markets. Nasdaq symbols are listed for all Nasdaq NMS issues. A more detailed explanation of Nasdaq ticker symbols appears with the NMS listings.

Footnotes:

c-New 52-week high.
l-New 52-week low.
a-Extra dividend or extras in addition to the regular dividend.
b-Indicates annual rate of the cash dividend and that a stock dividend was paid.
e-Liquidating dividend
ee-P/E ratio is 100 or more.
dd-Loss in the most recent four quarters.
e-Indicates a dividend was declared in the preceding 12 months, but that there isn't a regular dividend rate. Amount shown may have been adjusted to reflect stock split, spinoff or other distribution.
FD-First day of trading.
f-Annual rate, increased on latest declaration.
g-Indicates the dividend and earnings are expressed in Canadian money. The stock trades in U.S. dollars. No yield or P/E ratio is shown.
gg-Special sales condition; no regular way trading.
h-Does not meet continued listing standards.
i-Indicates amount declared or paid after a stock dividend or split.
j-Indicates dividend was paid this year, and that at the last dividend meeting a dividend was omitted or deferred.
k-Indicates dividend declared this year on cumulative issues with dividends in arrears.
lf-Late filing.
m-Annual rate, reduced on latest declaration.
n-Newly issued in the past 52 weeks. The high-low range begins with the start of trading and doesn't cover the entire period.
p-Initial dividend; no yield calculated.
pf-Preferred.
pp-Holder owes installment(s) of purchase price.
pr Preference.
q-Temporary exemption from Nasdaq requirements.
r-Indicates a cash dividend declared in the preceding 12 months, plus a stock dividend.
rt-Rights.
s-Stock split or stock dividend, or cash or cash equivalent distribution, amounting to 10% or more in the past 52 weeks. The high-low price is adjusted from the old stock. Dividend calculations begin with the date the split was paid or the stock dividend occured.
stk-Paid in stock in the last 12 months. Company doesn't pay cash dividend.
t-NYSE bankruptcy
un Units.
v-Trading halted on primary market.
vj-In bankruptcy or receivership or being reorganized under the Bankruptcy Code, or securities assumed by such companies.
wd-When distributed.
wi When issued
wt-Warrants.
ww-With warrants
x-Ex-dividend, ex-distribution, ex-rights or without warrants.
z-Sales in full, not in 100s.

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www.nasdaq.com

The NASDAQ and OTC Market. Securities not sold on one of the organized exchanges such as the NYSE and AMEX are traded over the counter (OTC). Unlike the centralized NYSE and AMEX exchanges, the over-the-counter markets do not have a physical trading floor. Rather, transactions are completed via an electronic market. The NASDAQ (National Association of Securities Dealers Automated Quotation) market is the world's first electronic stock market. The NASDAQ system provides continuous trading for the most active stocks traded over the counter. Indeed, as seen in Figures 9–7 through 9–9, the NASDAQ currently has more firms listed than the NYSE. Further, during the tech boom in the late 1990s, the dollar and share volume of trading on the NASDAQ exceeded that on the NYSE. As the tech boom crashed in the early 2000s, however, the NYSE again saw the greatest dollar and share volume of trading.

The NASDAQ market is primarily a dealer market, in which dealers are the market makers who stand ready to buy or sell particular securities. Unlike the NYSE (or AMEX), many dealers, in some cases more than 20, will make a market for a single stock—that is, quote a bid (buy) and ask (sell) price. There are no limits on the number of stocks a NASDAQ market maker can trade or on the number of market makers in a particular stock. A NASDAQ broker or dealer may also be a member of an organized exchange (e.g., the NYSE). Moreover, the original underwriter of a new issue can also become the dealer in the secondary market—unlike the NYSE, which seeks a separation between underwriters and dealers.[8] Anyone who meets the fairly low capital requirements for market makers on the NASDAQ can register to be a broker-dealer.

An individual wanting to make a trade contacts his or her broker. The broker then contacts a dealer in the particular security to conduct the transaction. In contrast to the NYSE and AMEX, the NASDAQ structure of dealers and brokers results in the NASDAQ being a negotiated market (e.g., quotes from several dealers are usually obtained before a transaction is made). When a request for a trade is received, a dealer will use the NASDAQ electronic communications network (ECN) to find the dealers providing the inside quotes—the lowest ask and the highest bid. The dealer may also request the quotes of every market maker in the stock. The dealer initiating the trade will then contact the dealer offering the best price and execute the order. The dealer will confirm the transaction with the investor's broker and the customer will be charged that quote plus a commission for the broker's services. Like exchange trading, online (Internet) trading services now allow investors to trade directly with a securities dealer without going through a personal broker.

Because of a lack of liquidity in the NASDAQ market after the 1987 market crash, and the negative impact this had on the ability of small traders to transact in this market, NASDAQ implemented a mandatory system, the Small Order Execution System (SOES), to provide automatic order execution for individual traders with orders of less than or equal to 1000 shares. Market makers must accept SOES orders, which means small investors and traders are provided with excellent liquidity. The SOES allows small investors and traders to compete on a level playing field for access to NASDAQ orders and execution.

For even smaller firms, NASDAQ maintains an electronic "OTC bulletin board," which is not part of the NASDQ market but is a means for brokers and dealers to get and post current price quotes over a computer network. Roughly 30,000 stocks trade on the over-the-counter market, which allows any security to be traded. The OTC market is not a formal exchange. There are no membership requirements for trading or listing requirements for securities. Thousands of brokers register with the SEC as dealers in OTC securities, quoting prices at which they are willing to buy or sell securities. A broker executes a trade by contacting a dealer listing an attractive quote. The smallest stocks are listed on "pink sheets" distributed through the National Association of Securities Dealers. These OTC quotations of stock are recorded manually and published daily on pink sheets by which dealers communicate their interest in trading at various prices.

8. A study by K. Ellis, R. Michaely, and M. O'Hara, "When the Underwriter Is the Market Maker: An Examination of Trading in the IPO Aftermarket," *Journal of Finance*, 2002, pp. 1039–1074, finds that the lead underwriter always becomes a market maker in a new issue and, in fact, becomes the most active dealer in issues it brings to the NASDAQ market.

Choice of Market Listing. Firms listed with the NYSE and AMEX markets must meet the listing requirements of the exchange. The requirements are extensive and can be found at the Web sites of the exchanges. The basic qualifications are based on such characteristics as firm market value, earnings, total assets, number of shares outstanding, number of shareholders, and trading volume. An NYSE-listed firm may also have its securities listed on regional exchanges. There are several reasons that NYSE listing is attractive to a firm: improved marketability of the firm's stock (making it more valuable); publicity for the firm, which could result in increased sales; and improved access to the financial markets, as firms find it easier to bring new issues of listed stock to the market.

The requirements for AMEX listing are generally less stringent than those for the NYSE. Thus, AMEX-listed firms tend to be smaller, less well known (therefore less traded), and often younger than NYSE firms.

Firms that do not meet the requirements for NYSE or AMEX exchange listing trade on the NASDAQ. Thus, most NASDAQ firms are smaller, of regional interest, or unable to meet the listing requirements of the organized exchanges. Many NASDAQ companies are newly registered public issues with only a brief history of trading. Over time, many of these apply for NYSE listing. Not all companies eligible to be listed on the NYSE actually do so. Some companies—for example, Microsoft—believe that the benefits of exchange listing (improved marketability, publicity) are not significant. Others prefer not to release the financial information required by the exchanges for listing.

Electronic Communication Networks and Online Trading. The major stock markets currently open at 9:30 a.m. eastern standard time and close at 4:00 p.m. eastern standard time. Extended-hours trading involves any securities transaction that occurs outside these regular trading hours. Almost all extended-hours trading is processed through computerized alternative trading systems (ATS), also known as electronic communications networks (ECNs) such as Archipelago, the Island, and Instinet. Nine equity ECNs are currently in operation. ECNs are computerized systems that automatically match orders between buyers and sellers and serve as an alternative to traditional market making and floor trading. They are also the major vehicles for extended-hours trading. ECNs account for approximately 38 percent of all NASDAQ transactions and almost all extended-hours trading, which averages 70 million shares per day. The majority of stocks traded on ECNs are NASDAQ-listed securities. Regulations limit the trading of exchanged-listed (e.g., NYSE) stocks on ECNs. However, these securities are beginning to find their way onto ECNs as several exchange-related rules are relaxed. ECNs were initially developed as private trading systems for institutional investors and brokers. However, they have opened their systems in varying degrees to include a greater number of institutions as well as individual investors. In April 2005, the NYSE announced that it would acquire Archipelago and the NASDAQ announced that it would acquire Instinet. Pressure on traditional markets like the NYSE and NASDAQ to match the rise of cheaper, faster computer systems for electronically matching stock trades of investors (like those used by Archipelago and Instinet) drove these acquisitions.

As a result of the increased availability of computer technology to individual as well as professional traders in the 1990s, online stock trading via the Internet became one of the biggest growth areas for financial service firms in the late 1990s and into the 2000s. For example, the number of online investment accounts in the United States increased from 3 million in 1997 to 18 million in 2000. However, with the drop in the stock markets after March 2001, growth in online trading activity fell. For example, the number of individuals who traded on the Internet on a typical day decreased 67 percent between March 2001 and September 2002. As the stock market improved in 2003, Internet trading again increased. At the end of 2004, online investment accounts numbered 11 million. However, 6 of 10 online traders stated that they wanted the option of speaking with a broker in person.[9] Online trading is an area of stock trading that is not likely to go away. The Internet will continue to produce opportunities for investors to communicate with their financial advisors and enact trades without incurring the cost of an office visit. For example, the top-level accounts offered by E*Trade now enable customers to view all of

9. See "Online Trading: Investors Take Charge," by Lynn Woods, *Kiplinger's Personal Finance,* January 2003, p. 28.

TABLE 9–4 Major Stock Market Indexes

Major Stock Indexes

	DAILY					52-WEEK			YTD
Dow Jones Averages	HIGH	LOW	CLOSE	NET CHG	% CHG	HIGH	LOW	% CHG	% CHG
30 Industrials	10850.18	10799.71	10800.30	– 28.89	– 0.27	10854.54	9749.99	+ 3.31	+ 3.31
20 Transportations	3823.96	3798.74	3808.60	– 1.69	– 0.04	3811.62	2750.80	+26.66	+26.66
15 Utilities	337.79	335.99	336.86	+ 0.70	+ 0.21	336.86	261.89	+26.21	+26.21
65 Composite	3417.78	3404.54	3405.08	– 3.77	– 0.11	3412.44	2852.12	+13.47	+13.47
Dow Jones Indexes									
Wilshire 5000	12010.55	11980.87	11987.82	+ 5.84	+ 0.05	11987.82	10293.52	+11.00	+11.00
US Total Market	290.31	289.60	289.74	+ 0.11	+ 0.04	289.74	250.37	+10.30	+10.30
US Large-Cap	260.80	260.08	260.11	– 0.02	– 0.01	260.21	229.69	+ 7.75	+ 7.75
US Mid-Cap	371.00	369.73	370.71	+ 0.66	+ 0.18	370.71	301.79	+18.47	+18.47
US Small-Cap	415.36	414.18	414.85	+ 0.31	+ 0.07	415.01	335.75	+15.98	+15.98
US Growth	1094.80	1091.99	1092.49	+ 0.31	+ 0.03	1092.49	944.85	+ 6.94	+ 6.94
US Value	1526.69	1522.96	1523.39	+ 0.16	+ 0.01	1523.39	1308.11	+12.88	+12.88
Global Titans 50	195.90	195.22	195.27	+ 0.07	+ 0.04	195.41	176.36	+ 5.77	+ 5.67
Asian Titans 50	119.72	117.62	119.55	+ 1.93	+ 1.64	119.55	98.30	+13.19	+13.22
DJ STOXX 50	2781.86	2774.47	2774.77	– 2.74	– 0.10	2804.06	2541.84	+ 4.30	+ 4.30
Nasdaq Stock Market									
Nasdaq Comp	2182.37	2176.40	2178.34	+ 1.34	+ 0.06	2178.34	1752.49	+ 8.73	+ 8.73
Nasdaq 100	1628.74	1621.58	1623.76	– 1.19	– 0.07	1627.46	1304.43	+10.62	+10.62
Biotech	774.21	771.13	771.88	– 0.89	– 0.12	845.11	622.19	+ 6.59	+ 6.59
Computer	968.10	965.11	965.49	+ 0.45	+ 0.05	1012.13	768.60	+ 3.27	+ 3.27
Standard & Poor's Indexes									
500 Index	1216.47	1213.41	1213.55	+ 0.10	+ 0.01	1213.55	1063.23	+ 9.14	+ 9.14
MidCap 400	664.73	661.95	664.50	+ 1.53	+ 0.23	664.50	549.51	+15.36	+15.36
SmallCap 600	329.86	328.92	329.01	– 0.29	– 0.09	329.58	263.47	+21.67	+21.67
SuperComp 1500	272.90	272.24	272.32	+ 0.06	+ 0.02	272.32	236.65	+10.11	+10.11
New York Stock Exchange and Others									
NYSE Comp	7265.41	7242.22	7253.56	+ 11.32	+ 0.16	7253.56	6217.06	+12.63	+12.63
NYSE Financial	7508.23	7476.92	7492.91	+ 15.90	+ 0.21	7492.91	6322.00	+12.23	+12.23
Russell 2000	654.45	652.99	653.06	– 0.28	– 0.04	654.57	517.10	+17.26	+17.26
Value Line	405.34	404.05	404.84	+ 0.66	+ 0.16	404.84	332.98	+11.63	+11.63
Amex Comp	n.a.	n.a.	1430.07	+ 3.34	+ 0.23	1426.73	1160.18	+21.86	+21.86

Source: *The Wall Street Journal*, Friday, December 31, 2004, p. C2. Reprinted by permission of The Wall Street Journal © 2004 Dow Jones & Company, Inc. All Rights Reserved Worldwide. **www.wsj.com**

their E*Trade accounts. A client with multiple brokerage accounts as well as bank accounts can view balances for all of these accounts. Customers can also see, in real time, the value of each account, the total value of all accounts together, and how account values have changed.

Stock Market Indexes

6

A stock market index is the composite value of a group of secondary market-traded stocks. Movements in a stock market index provide investors with information on movements of a broader range of secondary market securities. Table 9–4 shows a listing of some major stock market indexes as of December 30, 2004. Figure 9–13 shows the trends in some of these indexes (the Dow Jones Industrial Average, the NYSE Composite Index,[10] the S&P Composite Index, the NASDAQ Composite Index, and the Wilshire 5000 Index) from 1989 through 2004. Notice that movements in these indexes are highly correlated over the 15-year period. Notice also that the correlation of the NASDAQ index deviated from the others in the late 1990s and early 2000s as technology stocks (listed mainly on the NASDAQ) soared in value (rising from 2300 in January 1999 to over 5000 by March 2000) then fell back to 1423 in September 2001. Indeed, notice that after a five-year period of unprecedented growth (1995–2000) for all of these indexes, the early 2000s, and the downturn in the U.S. economy, produced little growth of these indexes. As the U.S. economy picked up through the first decade of the 2000s, however, all four indexes grew steadily.

www.dowjones.com

www.nyse.com

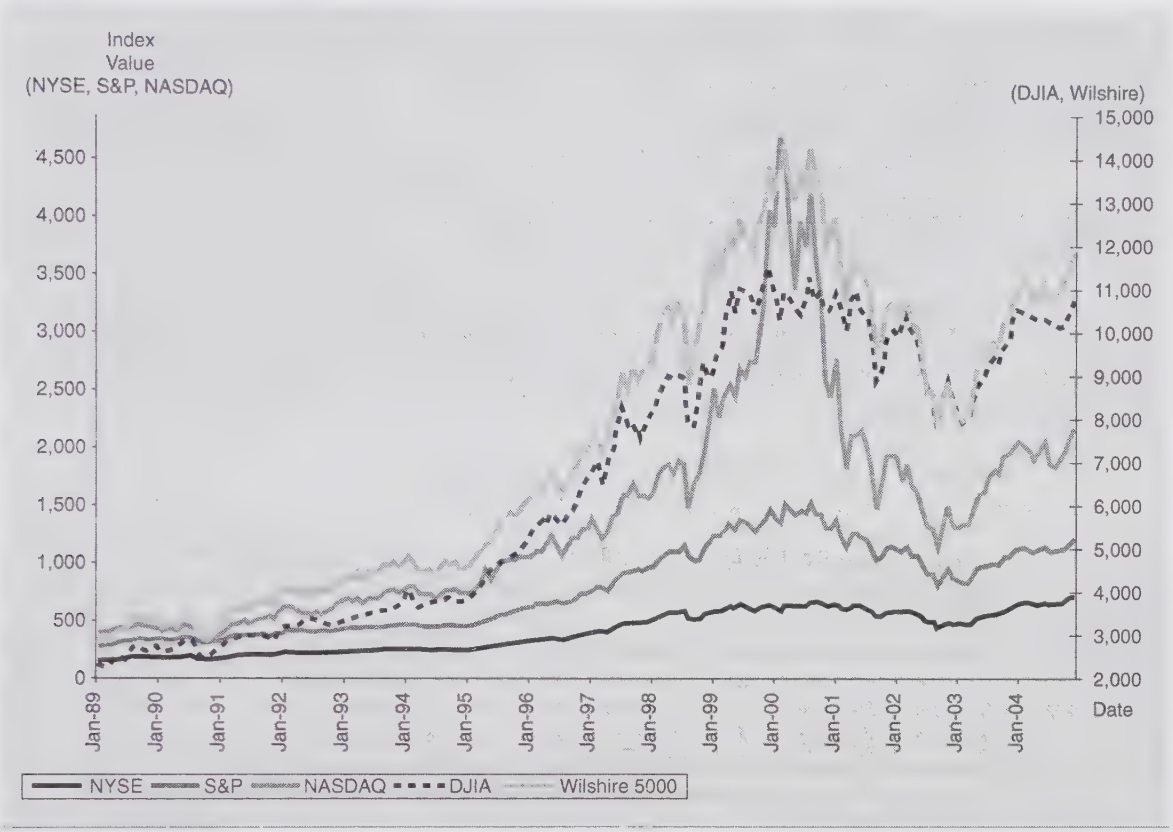
www.standardandpoors.com

www.nasdaq.com

www.wilshire.com

10. Figure 9–13 does not incorporate the change in base value from 50 to 5,000 on the NYSE Composite Index on December 31, 2002 (see below).

FIGURE 9–13 DJIA, NYSE Composite Index, S&P Composite Index, NASDAQ Composite Index, and Wilshire 5000 Index Values



Source: Dow Jones, the New York Stock Exchange, Standard & Poor's, NASDAQ, and Wilshire Web sites, various dates.

The Dow Jones Industrial Average. The Dow Jones Industrial Average (the DJIA or the Dow) is the most widely reported stock market index. The DJIA was first published in 1896 as an index of 12 industrial stocks. In 1928, the Dow was expanded to include the values of 30 large (in terms of sales and total assets) corporations selected by the editors of *The Wall Street Journal* (owned by Dow Jones & Company). In choosing companies to be included in the DJIA, the editors look for the largest companies with a history of successful growth and with interest among stock investors. The composition of the DJIA was most recently revised in April 2004, when AT&T, Eastman Kodak, and International Paper were replaced by American International Group (AIG), Pfizer, and Verizon Communications. Table 9–5 lists the 30 NYSE and NASDAQ corporations included in the DJIA. Dow Jones and Company has also established and publishes indexes of 20 transportation companies, 15 utility companies, and a composite index consisting of all 65 companies in the industrial, transportation, and utility indexes.

Dow indexes are *price-weighted averages,* meaning that the stock *prices* of the companies in the indexes are added together and divided by an adjusted value, (or divisor) as follows:

$$\sum_{i=1}^{30} P_{it}/\text{Divisor}$$

where

P_{it} = Price of each stock in the Dow index on day t

TABLE 9–5 Dow Jones Industrial Average Companies

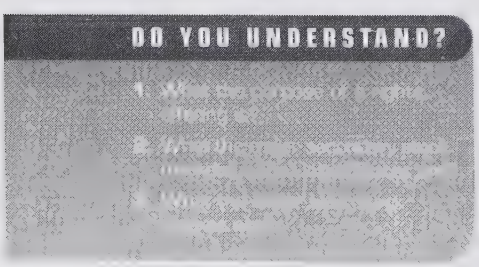
Altria Group (formerly Philip Morris)	IBM
Aluminum Company of America	Intel
American Express	Johnson & Johnson
American International Group (AIG)	J. P. Morgan Chase
Boeing	McDonald's
Caterpillar	Merck
Citigroup	Microsoft
Coca-Cola	Minnesota Mining & Manufacturing (3M)
DuPont	Pfizer
Exxon Mobil	Procter & Gamble
General Electric	SBC Communications
General Motors	United Technologies
Hewlett-Packard	Verizon Communications
Home Depot	Wal-Mart
Honeywell	Walt Disney

Source: Dow Jones & Company Web site, December 2004. **www.dowjones.com**

The divisor was set at 30 in 1928, but due to stock splits, stock dividends, and changes in the 30 firms included in the index, this value dropped to 0.13532775 by the end of 2004.

The NYSE Composite Index. In 1966, the NYSE established the NYSE Composite Index to provide a comprehensive measure of the performance of the overall NYSE market. The index consists of all common stocks listed on the NYSE. In addition to the composite index, NYSE stocks are divided into four subgroups: industrial, transportation, utility, and financial companies. The indexed value of each group is also reported daily.

The NYSE is a *value-weighted index,* meaning that the *current market values* (stock price × number of shares outstanding) of all stocks in the index are added together and divided by their value on a base date. Any changes in the stocks included in the index are incorporated by adjusting the base value of the index. To modernize and align the index methodology with those used in other indexes, the NYSE revised its NYSE Composite Index in January 2003. At this time the composite was recalculated to reflect a new base value of 5,000 rather than the original base value of 50 set in December 1965.



The Standard & Poor's 500 Index. Standard & Poor's established the S&P 500 index (a value-weighted index) consisting of the stocks of 500 of the largest U.S. corporations listed on the NYSE and the NASDAQ. The NYSE stocks included in the S&P 500 index account for over 80 percent of the total market value of all stocks listed on the NYSE. Thus, movements in the S&P 500 Index are highly correlated with those of the NYSE Composite Index (the correlation between the two indices was .96 from 1989 through June 2004—see Figure 9–13). Standard & Poor's also reports subindexes consisting of industrials and utilities in the S&P 500 Index.

The NASDAQ Composite Index. Established in 1971, the NASDAQ Composite Index (a value-weighted index) consists of three categories of NASDAQ companies: industrials, banks, and insurance companies. All stocks traded through the NASDAQ in these three industries are included. NASDAQ also reports separate indexes based on industrials, banks, insurance companies, computers, and telecommunications companies.

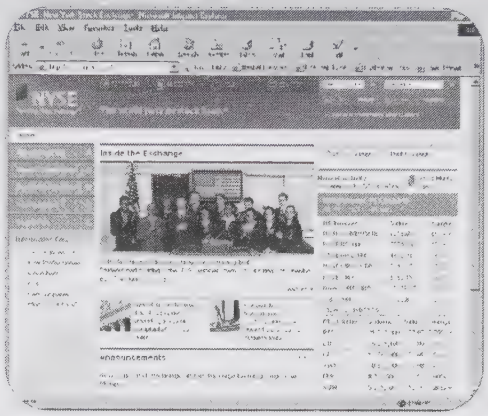
The Wilshire 5000 Index. The Wilshire 5000 Index was created in 1974 (when computers made the daily computation of such a large index possible) to track the value of the entire

SEARCH THE SITE

Go to the NYSE Web site at **www.nyse.com** and find the most recent information on the NYSE market indexes.

Under "Market Information" click on "Indexes"

This will bring up the summary of the NYSE indexes.



Questions

1. What is the high and low value for the NYSE Composite Index over the last year?
2. Calculate the percentage change in the NYSE Composite and NYSE Financial Indices over the last year.

stock market. It is the broadest stock market index and possibly the most accurate reflection of the overall stock market. The Wilshire 5000 Index contains virtually every stock that meets three criteria: the firm is headquartered in the United States; the stock is actively traded in a U.S.-based stock market; and the stock has widely available price information (which rules out the smaller OTC stocks from inclusion). Though the index started with 5,000 firms, it currently includes more than 6,700 stocks. Like the NYSE Composite Index, the S&P 500 Index, and the NASDAQ Composite Index, the Wilshire 5000 Index is a value-weighted index. The Wilshire 5000 Index has the advantage that it is the best index to track the path of the U.S. stock market. Since it includes essentially every public firm, it is highly representative of the overall market. However, because it is so diverse, determining which sectors or asset classes (technology, industrial, small-cap, large-cap, etc.) are moving the market is impossible.

EXAMPLE 9–6 Price-Weighted versus Value-Weighted Indexes

Suppose a stock index contains stock of four firms: W, X, Y, and Z. The stock prices for the four companies are \$50, \$25, \$60, and \$5, respectively, and the firms have 100 million, 400 million, 200 million, and 50 million shares outstanding, respectively. If the index is price-weighted, its initial value, *PWI*, is calculated as:

$$\begin{aligned} PWI &= \sum_{i=1}^{4} P_{it}/4 \\ &= (\$50 + \$25 + \$60 + \$5)/4 \\ &= 140/4 \\ &= 35 \end{aligned}$$

If the index is value-weighted, its initial value, *VWI*, is:

$$\begin{aligned} VWI &= \sum_{i=1}^{4} (P_{it} \times \text{number of shares outstanding})/4 \\ &= ((\$50 \times 100\text{m}) + (\$25 \times 400\text{m}) + (\$60 \times 200\text{m}) + (\$5 \times 50\text{m}))/4 \\ &= \$6{,}812.5 \text{ million} \end{aligned}$$

If the next day, share prices change to \$55, \$24, \$62, and \$6, respectively, the price-weighted index value changes to:

$$\begin{aligned} PWI &= \sum_{i=1}^{4} P_{it}/4 \\ &= (\$55 + \$24 + \$62 + \$6)/4 \\ &= 147/4 \\ &= 36.75 \end{aligned}$$

and the percentage change in the index is (36.75 – 35)/35 = 5 percent. The value-weighted index is now:

$$\begin{aligned} VWI &= \sum_{i=1}^{4} (P_{it} \times \text{number of shares outstanding})/4 \\ &= ((\$55 \times 100\text{m}) + (\$24 \times 400\text{m}) + (\$62 \times 200\text{m}) + (\$6 \times 50\text{m}))/4 \\ &= \$6{,}950 \text{ million} \end{aligned}$$

and the percentage change in this index is (6,950 – 6,812.5)/6,812.5 = 2.02 percent.

If, after the market closes, company W undergoes a two-for-one split, its stock price falls to \$55/2 = \$27.50 and the number of shares increases to 200 million. The prices now sum to \$119.50. At the same time the divisor on the price-weighted index adjusts such that:

$$\begin{aligned} \text{Divisor} &= 119.5/36.75 \\ &= 3.2517 \end{aligned}$$

Thus, the value of the price-weighted index remains at:

$$\begin{aligned} PWI &= \sum_{i=1}^{4} P_{it}/3.2517 \\ &= (\$27.50 + \$24 + \$62 + \$6)/3.2517 \\ &= 119.5/3.2517 \\ &= 36.75 \end{aligned}$$

Further, the value-weighted index remains unchanged at 6950. Both indexes are unaffected by the stock split. Apparent from this example, however, is that the firms included in the index and the weighting process used affect values of the reported changes in the overall stock market.

STOCK MARKET PARTICIPANTS

Table 9–6 shows the holdings of corporate stock from 1994 through 2004 by type of holder. Households are the single largest holders of corporate stock (holding 39.2 percent of all corporate stock outstanding in 2004). Mutual funds and private and public pension funds are also prominent in the stock markets (holding 22.0 percent, 9.8 percent, and 7.5 percent of the \$15.63 trillion in corporate stock outstanding, respectively).

As a result of the tremendous increase in stock values in the 1990s, most individuals in the United States either directly own corporate stock or indirectly own stock via investments in mutual funds and pension funds. Figure 9–14 shows the age distribution of adult stockholders by percentage of all shareholders and percentage of shares owned. While over 50 percent of all stockholders are under 45 years of age, this group owns just 23.0 percent of all stock outstanding. The major investors (holding 53.0 percent of all stock outstanding) are those 37.3 percent of the market participants between 45 and 64 years old.

Table 9–7 reports characteristics of adult investors in the stock markets, classified as All Adults, Baby Boomers (born between 1947 and 1962), and Senior Citizens (those 65 years and older). Approximately 34 percent of stock investors are employed as professionals or executives, while 38 percent have a college degree.

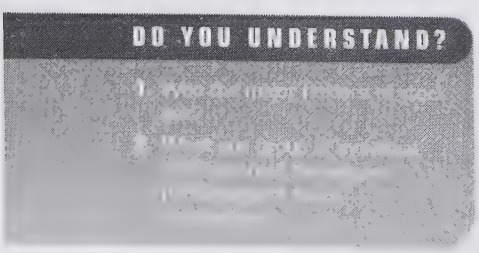


TABLE 9–6 Holders of Corporate Stock
(in billions of dollars)

	1999	1999	2000	2002	2004	Percent of 2004 Total
Household sector	$3,070.9	$5,689.6	$7,317.1	$5,045.2	$6,132.7	39.2%
State and local governments	10.6	79.0	115.1	80.3	87.6	0.6
Rest of world	397.7	919.5	1,748.3	1,260.8	1,670.3	10.7
Depository institutions	180.6	331.4	315.2	213.7	260.1	1.7
Life insurance companies	246.1	558.6	940.8	708.9	962.4	6.2
Other insurance companies	112.1	186.0	194.3	152.3	187.5	1.2
Private pension funds	996.3	1,863.9	2,195.1	1,096.7	1,536.3	9.8
Public pension funds	557.4	1,431.7	1,335.1	918.3	1,180.3	7.5
Mutual funds	709.6	2,018.7	3,292.5	2,286.2	3,431.7	22.0
Closed-end funds	31.9	50.2	35.7	33.7	70.8	0.4
Brokers and dealers	20.1	51.9	77.2	74.9	107.5	0.7

Source: Federal Reserve Board Web site, various issues. **www.federalreserve.gov**

The mean family income of stock investors is $84,900, and the mean value of investors' overall investment portfolios is $148,500. Baby boomers have smaller investment portfolios, $115,800, than the average, and senior citizens are the largest group of investors, with a mean investment portfolio valued at $267,700.

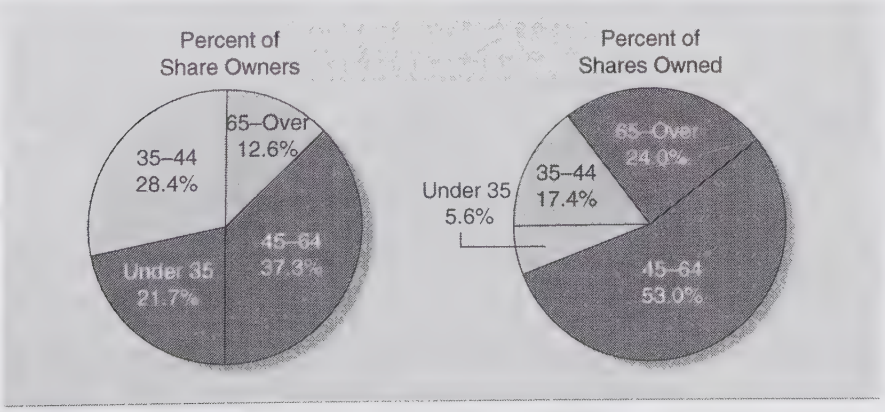
OTHER ISSUES PERTAINING TO STOCK MARKETS

Economic Indicators

In Appendix 3A to Chapter 3, located at the book's Web site (**www.mhhe.com/sc3e**), we used time value of money equations to determine the fair value of a stock. Specifically, we saw that the fair value of a stock today (P_0) could be represented as:

$$P_0 = \frac{D_1}{(1+i_s)^1} + \frac{D_2}{(1+i_s)^2} + \cdots + \frac{D_\infty}{(1+i_s)^\infty}$$

FIGURE 9–14 Distribution of Common Stock Ownership by Age



Source: *NYSE Shareownership*, New York Stock Exchange, 2000. **www.nyse.com**

TABLE 9–7 Profiles of Adult Stockholders

	All Adults	Baby Boomers	Senior Citizens
Employed:	77.0%	87.8%	20.7%
Occupation (conditional on working):			
Professional/Executive	33.8	39.1	37.3
Clerical, technical, or sales	20.3	21.9	16.8
Education:			
Completed college	38.0	39.4	33.6
Any postgraduate work	15.9	16.6	16.0
Family status:			
Married	82.0	85.6	72.8
Widowed	3.2	0.5	17.9
Portfolio attributes:			
Has brokerage account	30.5	29.3	45.6
Willing to take risk	82.3	83.8	61.5
Owns IRA or Keogh	51.4	49.1	69.0
Owns mutual fund	31.9	30.4	45.7
Only one stock owned	13.4	10.4	14.9
Median age	44	43	71
Median family income (000s)	$57.0	$64.0	$40.0
Mean family income (000s)	$84.9	$94.1	$68.1
Median portfolio value (000s)	$28.0	$31.0	$63.0
Mean portfolio value (000s)	$148.5	$115.8	$267.7
Mean number of stocks held	2.3	1.9	4.7
Mean number of stocks held if hold stocks directly	3.4	2.1	5.2

Notes: Tabulations from the 1998 Survey of Consumer Finances. Baby boomer shareholders are those born between 1947 and 1962. Senior citizen shareholders are those aged 65 and above in 1998.

Source: *NYSE Shareownership*, The New York Stock Exchange, 2002. **www.nyse.com**

The present value of a stock today is the discounted (at a rate i_s) sum of the expected future dividends (D_i) to be paid on the stock. As expected future dividends increase (decrease), stock prices should increase (decrease). Appendix 9A to this chapter (located at the book's Web site, **www.mhhe.com/sc3e**) reviews the Capital Asset Pricing Model used to determine an appropriate interest rate at which to discount these dividends.

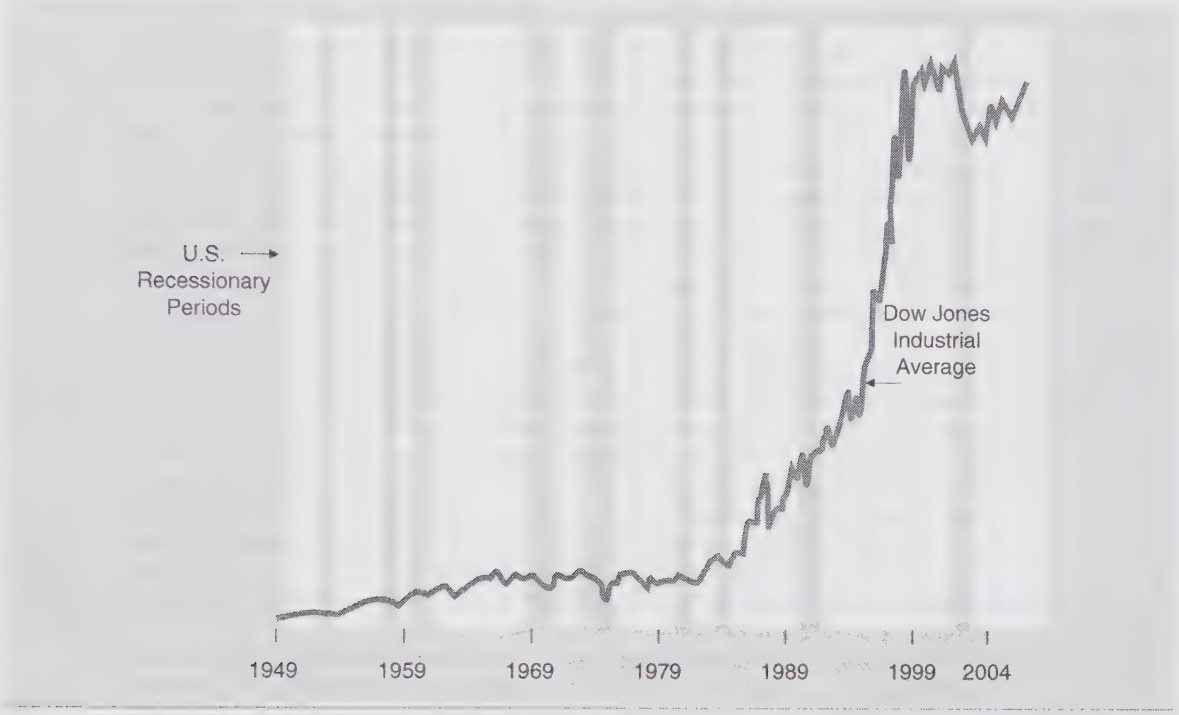
To the extent that today's stock values reflect expected future dividends, stock market indexes might be used to forecast future economic activity. An increase (decrease) in stock market indexes today potentially signals the market's expectation of higher (lower) corporate dividends and profits and, in turn, higher (lower) economic growth. To the extent that the market's assessment of expected dividends is correct, stock market indexes can be predictors of economic activity. Indeed, stock prices are one of the 10 variables included in the index of leading economic indicators used by the Federal Reserve as it formulates economic policy (see Chapter 4).[11]

www.federalreserve.gov

Figure 9–15 shows the relation between stock market movements (using the DJIA) and economic cycles in the United States. Notice some recessionary periods (represented in Figure 9–15 by the shaded bars) were indeed preceded by a decline in stock market

11. The other indicators include average weekly hours of manufacturing production workers; average weekly initial claims for unemployment insurance; manufactures' new orders, consumer goods and materials; vendor performance, slower diffusion index; manufacturers' new orders, nondefense capital goods; building permits for new private housing units; money supply; interest rate spread, 10-year Treasury bonds less fed funds; and index of consumer expectations. These data, tabulated by the National Bureau of Economic Research (NBER), are available in the *Survey of Current Business*.

FIGURE 9–15 The Relation between Stock Market Movements and Economic Activity



Source: Dow Jones & Company Web site and National Bureau of Economic Research Web site, December 2004. **www.dowjones.com; www.nber.org**

index values; other recessionary periods were not preceded by a decline in stock market index values. Figure 9–15 suggests that stock market movements are not consistently accurate predictors of economic activity. In fact, a study by researchers at the Federal Reserve Bank of Kansas City found that only 11 of 27 recessions in the United States between 1900 and 1987 were preceded by declines in stock market values.[12]

Market Efficiency

8

As discussed above (and in Chapter 3), theoretically, the *current* market price of a stock equals the present value of its expected future dividends (or the *fair* market value of the security). However, when an event occurs that unexpectedly changes interest rates or a characteristic of the company (e.g., an unexpected dividend increase or decrease in default risk), the current market price of a stock can temporarily diverge from its fair present value. When market traders determine that a stock is undervalued (i.e., the current price of the stock is less than its fair present value), they will purchase the stock, thus driving its price up. Conversely, when market traders determine that a stock is overvalued (i.e., its current price is greater than its fair present value), they will sell the stock, resulting in a price decline.

market efficiency
The speed with which financial security prices adjust to unexpected news pertaining to interest rates or a stock-specific characteristic.

The degree to which financial security prices adjust to "news" and the degree (and speed) with which stock prices reflect information about the firm and factors that affect firm value is referred to as **market efficiency**.[13] Three measures (weak form, semistrong form, and strong form market efficiency) are commonly used to measure the degree of

12. See Byron Higgins, "Is a Recession Inevitable This Year?" *Economic Review,* Federal Reserve Bank of Kansas City, January 1988, pp. 3–16.

13. While we discuss market efficiency in the context of stock markets, it also applies to the speed with which any security's price changes in response to new information.

stock market efficiency. The measures differ in the type of information or news (e.g., public versus private, historic versus nonhistoric) that is impounded into stock prices.

Weak Form Market Efficiency. According to the weak form of market efficiency, current stock prices reflect all historic price and volume information about a company. Old news and trends are already impounded in historic prices and are of no use in predicting today's or future stock prices. Thus, weak form market efficiency concludes that investors cannot make more than the fair (required) return using information based on historic price movements.

Empirical research on weak form market efficiency generally confirms that markets are weak form efficient. Evidence suggests that successive price changes are generally random and that the correlation between stock prices from one day to the next is virtually zero. Thus, historical price and volume trends are of no help in predicting future price movements (and technical analysis has no value as a trading strategy).

Semistrong Form Market Efficiency. The semistrong form market efficiency hypothesis focuses on the speed with which public information is impounded into stock prices. According to the concept of semistrong form market efficiency, as public information arrives about a company, it is immediately impounded into its stock price. For example, semistrong form market efficiency states that a common stock's value should respond immediately to unexpected news announcements by the firm regarding its future earnings. Thus, if an investor calls his or her broker just as the earnings news is released, that investor cannot earn an abnormal return. Prices have already (immediately) adjusted. According to semistrong form market efficiency, investors cannot make more than the fair (required) return by trading on public news releases.

Since historical information is a subset of all public information, if semistrong form market efficiency holds, weak form market efficiency must hold as well. However, it is possible for weak form market efficiency to hold when semistrong form market efficiency does not. This implies that investors can earn abnormal returns by trading on current public news releases. The quicker the stock market impounds this information, the smaller any abnormal returns will be.

Semistrong form market efficiency has been examined by testing how security prices react to unexpected news releases or announcement "events" (event studies—see Appendix 9B to this chapter located at the book's Web site (**www.mhhe.com/sc3e**)). Some specific announcements that have been tested include macroeconomic events such as interest rate changes and firm-specific announcements such as earnings and dividend changes, stock splits, brokerage house buy and sell recommendations, and mergers and acquisitions. Financial markets have generally been found to immediately reflect information from news announcements.

Strong Form Market Efficiency. The strong form of market efficiency states that stock prices fully reflect all information about the firm, both public and private. Thus, according to strong form market efficiency, even learning private information about the firm is of no help in earning more than the required rate of return. As individuals[14] get private information about a firm, the market has already reacted to it and has fully adjusted the firm's common stock price to its new equilibrium level. Thus, strong form market efficiency implies that there is no set of information that allows investors to make more than the fair (required) rate of return on a stock.

If strong form market efficiency holds, semistrong form market efficiency must hold as well. However, semistrong form market efficiency can hold when strong form market efficiency does not. This implies that private information can be used to produce abnormal returns, but as soon as the private or inside information is publicly released, abnormal returns are unobtainable.

14. How institutional investors factor into efficient markets raises questions. Many consider institutional investors to have private information that results from better analysis of public information and greater resources. Obviously, whether these institutions can expect to discover the private information and thus expect to earn abnormal returns in the long run is an issue. Indeed, whether the information set of institutions belongs in the semistrong or strong form group is arguable.

Because private information is not observable, testing for strong form market efficiency is difficult. As a result, there are few studies testing its validity. The limited empirical tests of strong form market efficiency examine information available to insiders. Generally, studies have found that corporate insiders (e.g., directors, officers, and chairs) do earn abnormal returns from trading and that the more informed the insider, the more often abnormal returns are earned. Therefore, information possessed by corporate insiders can be used in trading to earn abnormal returns.

Because private information can be used to earn abnormal returns, laws prohibit investors from trading on the basis of private information (insider trading) although they can trade, like any investor, based on publicly available information about the firm. For example, in June 2002 the FBI and SEC arrested Dr. Samuel Waksal on criminal charges of trying to sell ImClone stock and tipping off family members and friends (including Martha Stewart) after learning that regulators would reject his company's promising cancer drug. Dr. Waksal and Ms. Stewart were sentenced to jail terms (of seven years and five months, respectively) as a result of this insider trading. To try to ensure that insider trading does not occur, publicly traded companies are required to file monthly reports with the Securities and Exchange Commission reporting every purchase and sale of the company's securities by officers and directors of the company. Even with this information, identifying trades driven by private (inside) as opposed to public information is often hard.

Stock Market Regulations

www.sec.gov

Stock markets and stock market participants are subject to regulations imposed by the Securities and Exchange Commission (SEC) as well as the exchanges on which stocks are traded. The main emphasis of SEC regulations is on full and fair disclosure of information on securities issues to actual and potential investors. The two major regulations that were created to prevent unfair and unethical trading practices on security exchanges are the Securities Act of 1933 and the Securities Exchange Act of 1934. The 1933 Act required listed companies to file a registration statement and to issue a prospectus that details the recent financial history of the company when issuing new stock. The 1934 Act established the SEC as the main administrative agency responsible for the oversight of secondary stock markets by giving the SEC the authority to monitor the stock market exchanges and administer the provisions of the 1933 Act. SEC regulations are not intended to protect investors against poor investment choices but rather to ensure that investors have full and accurate information available when making their investment decisions.

For example, in October 2000, the SEC adopted Regulation FD (Fair Disclosure) to combat selective disclosure. Selective disclosure occurs when stock issuers release nonpublic information about their company to selected persons, such as securities analysts or institutional investors, before disclosing the information to the general public. This practice undermines the integrity of the securities markets and reduces investor confidence in the fairness of the markets. Selective disclosure also may create conflicts of interests for securities analysts, who may have an incentive to avoid making negative statements about an issuer for fear of losing their access to selectively disclosed information. Regulation FD requires that any material information released by a firm be done so to the general public and not selectively.

In 2001 a number of securities firms received tremendous publicity concerning conflicts of interest between analysts' research recommendations on buying or not buying stocks and whether the firm played a role in underwriting the securities of the firm the analysts were recommending. After an investigation by the New York State's attorney general, Merrill Lynch agreed to pay a fine of $100 million and to follow procedures more clearly separating analysts' recommendations (and their compensation) from the underwriting activities of the firm. Major Wall Street firms were also investigated (see below). This investigation was triggered by the dramatic collapse of many new technology stocks while analysts were still making recommendations to buy or hold them.

Subsequent to these investigations, the SEC instituted rules requiring Wall Street analysts to vouch that their stock picks are not influenced by investments banking colleagues and that

analysts disclose details of their compensation that would flag investors to any possible conflicts. Evidence that analysts have falsely attested to the independence of their work could be used to institute enforcement actions. Violators could face a wide array of sanctions, including fines and penalties such as a suspension or a bar from the securities industry. In addition, the SEC proposed that top officials from all public companies sign off on financial statements.

Along with these changes instituted by the SEC, the U.S. Congress passed the Sarbanes-Oxley Act in July 2002. This act created an independent auditing oversight board under the SEC, increased penalties for corporate wrongdoers, forced faster and more extensive financial disclosure, and created avenues of recourse for aggrieved shareholders. Further, in 2002 the NYSE took actions intended to heighten corporate governance standards on domestic NYSE-listed companies. Key changes included requirements on companies to have a majority of independent directors, to adopt corporate governance guidelines and codes of ethics and business conduct, to have shareholders' approval of all equity-based compensation plans, and to have CEOs annually certify information given to investors. The goal of the legislation was to prevent deceptive accounting and management practices and to bring stability to jittery stock markets battered in the summer of 2002 by corporate governance scandals of Enron, Global Crossings, Tyco, WorldCom, and others.

In the spring of 2003 an agreement was announced between regulators and 10 of the nation's largest securities firms to pay a record $1.4 billion in penalties to settle charges involving investor abuses. The long-awaited settlement centered on civil charges that securities firms routinely issued overly optimistic stock research to investors in order to gain favor with corporate clients and win their investment banking business. The agreement also settled charges that at least two big firms, Citigroup and Credit Suisse First Boston, improperly allocated IPO shares to corporate executives to win banking business from their firms. The SEC and other regulators, including the NASD, the NYSE, and state regulators, unveiled multiple examples of how Wall Street stock analysts tailored their research reports and ratings to win investment banking business. The Wall Street firms agreed to the settlement without admitting or denying any wrongdoing. The agreement forced brokerage companies to make structural changes in the way they handle research—preventing, for example, analysts from attending certain investment banking meetings with bankers. The agreement also required securities firms to have separate reporting and supervisory structures for their research and banking operations and required that analysts' pay be tied to the quality and accuracy of their research, rather than the amount of investment banking business they generate.

This was not the end, however. Investors of several companies sued investment banks for actions taken to mislead investors such as falsifying financial statements and hiding debt. Seeking to end these suits, investment banks settled many of them. For example, in June 2005, J.P. Morgan Chase paid $2.2 billion and Citigroup paid $2 billion to investors of Enron to settle a class-action lawsuit filed by this group. This followed a $2 billion payout to investors of WorldCom by J.P. Morgan Chase to settle a similar lawsuit.

The SEC has delegated certain regulatory responsibilities to the markets (e.g., NYSE or NASDAQ). In these matters, the NYSE and NASDAQ are self-regulatory organizations. Specifically, the NYSE has primary responsibility for the day-to-day surveillance of trading activity. It monitors specialists to ensure adequate compliance with their obligation to make a fair and orderly market; monitors all trading to guard against unfair trading practices; monitors broker-dealer activity with respect to minimum net capital requirements, standards, and licensing; and enforces various listing and disclosure requirements.

www.nyse.com

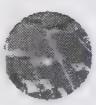
In October 2003, the SEC criticized the NYSE for failing to police its specialists and ignoring blatant violations in which investors were cheated out of millions of dollars in trades involving more than two billion shares over the 2001–2003 period. The confidential report painted a picture of a floor trading system riddled with abuses, with specialist firms routinely placing their own trades ahead of those of customers, and of an NYSE that was ill-equipped or unwilling to address the problems. The report concluded that when the NYSE did act on investor abuses, it often did little more than admonish the specialists in a letter or

assess a small fine. In response to the criticism, the NYSE agreed to make improvements to curb alleged abuses. Actions by the NYSE against trading abuses did pick up in 2004. For example, in June 2004, the NYSE fined ($100,000) and suspended (for six weeks) an executive at Morgan Stanley who oversaw large stock trades. The NYSE alleged that the executive placed trades to bolster a stock in the firm's own trading account in order to limit losses Morgan Stanley would take on the stock. In November 2004, the NYSE warned firms on the floor to monitor closely communications they have with corporate executives to make sure the firms do not leak market-moving information or succumb to improper pressure to manipulate prices. NYSE rules require specialists to give companies periodic updates on their stocks' trading. But the companies' executives are not allowed to call specialists during trading hours, which had happened on at least one occasion, prompting the NYSE warning. Finally, in December 2004 Knight Securities was fined $79 million in penalties to settle an investigation pertaining to the cheating of stock clients over a three-year period from 1999 to 2001. Regulators alleged that Knight Trading Group traders routinely delayed filling clients' stock orders to trade for the firm's own account, pocketing commissions of several dollars per share rather than the standard pennies per share.

DO YOU UNDERSTAND?

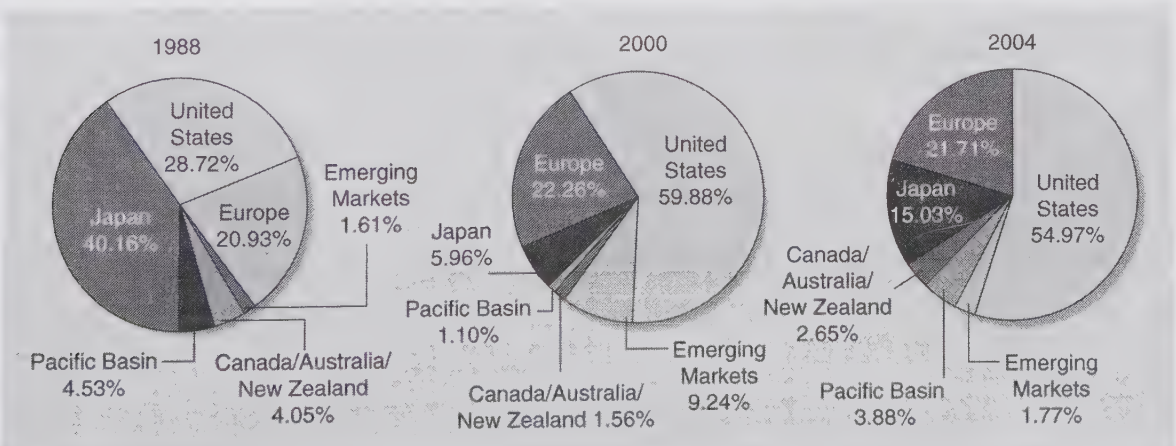
The National Association of Securities Dealers (NASD) has the primary responsibility for regulating brokers and dealers on the NASDAQ market. It requires its members to meet certain standards of conduct in issuing and selling securities and monitors members to prevent them from profiting unreasonably at the expense of their customers. The NASD also conducts field examinations of its member firms at least once a year and can censure, fine, suspend, or expel a broker-dealer from the NASD if violations are found.

INTERNATIONAL ASPECTS OF STOCK MARKETS



The U.S. stock markets are the world's largest. However, European markets are becoming an increasing force, and with the full implementation of a common currency, the euro, in 2002, they should continue to grow in importance. Figure 9–16 shows the proportion of stock market capitalization among major countries in 1988, 2000, and 2004. The U.S. dominance in the stock markets is best seen in 2000 and 2004. Note also the stock market developments in Europe and the Pacific Basin countries from 1988 to 2000. While the European markets have increased their market share (from 20.93

FIGURE 9–16 Worldwide Stock Market Capitalization



Source: *Emerging Stock Markets Fact Book, 1998 and 2001;* International Finance Corporation, December 2004. **www.ifc.org**

to 21.71 percent of the total), the Asian economic problems that started in 1997 reduced the value of these markets significantly (for example, Japanese and Pacific Basin stock markets decreased from 40.16 and 4.53 percent in 1988 to 5.96 and 1.10 percent in 2000 of the worldwide stock markets, respectively, before recovering to 15.03 and 3.88 percent, respectively, as the economies recovered).

From an investor's viewpoint, international stock markets are attractive because some risk can be eliminated (diversified away—see Chapter 20) by holding the stocks issued by corporations in foreign countries. For example, while a stock issued by a corporation in one country might be reduced in value by a recessionary slowdown, increases in the value of stocks issued by a corporation in another country (that is experiencing economic growth or an appreciation in the foreign exchange rate of its currency) can offset those losses. A recent (1976–1999) look at correlations in stock returns in the United States, Europe, and the Pacific Basin countries shows that diversification opportunities do indeed exist.[15] For example, the correlation coefficient on (local currency) stock returns in the United States versus the United Kingdom was 0.50, and in the United States versus Hong Kong was 0.37.[16]

EXAMPLE 9–7 Returns from International Portfolio Diversification

Suppose you owned stock in a U.S. company and a U.K. company. U.S. dollars were converted to British pounds last year to make the investment, and pounds were converted back to dollars as you liquidated the investment. Also suppose the exchange rate of British pounds into U.S. dollars was 1.8081 last year and is now 1.8909. Thus, the pound appreciated relative to the dollar over the investment period. The details of the two stock investments are as follows:

	U.S. Stock	U.K. Stock		U.S. Dollar Equivalent for U.K. Stocks
Purchase price, P_{t-1}^C	\$50	£60	=	\$108.486
Sale price, P_t^C	\$48	£64	=	\$121.0176
Dividends, D_t^C	\$1.50	£2.50	=	\$4.72725

The return on the U.S. company's stock was:

$$R_t^{US} = \frac{\$48 - \$50}{\$50} + \frac{\$1.5}{\$50} = -1\%$$

and the return on the U.K. company's stock, ignoring the change in the exchange rate, was:

$$R_t^{UK} = \frac{£64 - £60}{£60} + \frac{£2.5}{£60} = 10.83\%$$

On a U.S. dollar equivalent basis the return was:

$$R_t^{UK} = \frac{\$121.0176 - \$108.486}{\$108.486} + \frac{\$4.72725}{108.486} = 15.91\%$$

The loss on the U.S. stock, 1 percent, was offset by an increase in the value of the U.K. stock, reflecting both an increase in its local market value and an appreciation in the pound relative to the dollar.

15. See A. Sarkar and K. Li, "Should U.S. Investors Hold Foreign Stocks?" *Current Issues,* Federal Reserve Bank of New York, March 2002.

16. A correlation coefficient of 1 means the returns move exactly together; a correlation coefficient of 0 means there is no relation in the return movements, and a correlation of negative 1 means the returns move in exactly the opposite direction.

While international diversification eliminates some risks, it introduces others. For example, for smaller investors, information about foreign stocks is less complete and timely than that for U.S. stocks. Further, international investments introduce foreign exchange risk (see Chapter 8) and political (or sovereign) risk (see Chapter 19).

As seen in Table 9–6 (Rest of world), foreign investors held $1,670.3 billion (or 10.7 percent) of the outstanding stock issued in the United States. Moreover, foreign companies issued $2,094.0 billion of the stocks in the United States (see Figure 9–1). Facilitating U.S. investment in stocks of foreign corporations is the creation of the American Depository Receipt (ADR). An ADR is a certificate that represents ownership of a foreign stock. An ADR is typically created by a U.S. bank, which buys stock in foreign corporations in their domestic currencies and places them with a custodian. The bank then issues dollar ADRs backed by the shares of the foreign stock. Each ADR is a claim on a given number of shares of stock held by the bank. These ADRs are then traded in the United States, in dollars, on and off the organized exchanges. The major attraction to U.S. investors is that ADRs are claims to foreign companies that trade on domestic (U.S.) exchanges *and* in dollars. Global Depository Receipts (GDRs) are similar to ADRs, but are issued worldwide.

There are currently over 2,000 ADRs of foreign corporations available to U.S. investors (mainly listed on the NYSE, the AMEX, or the NASDAQ). ADR trading volume in 2004 (through November) exceeded 33.4 billion shares and the average daily volume was $3.46 billion. The Bank of New York is the main issuer of ADRs. Through ADRs, over 20 percent of the shares of the top 100 non-U.S. companies (such as Nokia and Royal Dutch Petroleum) ranked by U.S. sales were owned by U.S. residents.

A further advantage of ADRs to U.S. investors is that the SEC requires companies with ADRs trading in the United States to file financial statements that are consistent with U.S. generally accepted accounting principles (GAAP). Thus, unlike direct investments in foreign corporations on their local exchanges, investors in ADRs can obtain and review significant amounts of (audited) information on the foreign firm that appears in a currency, language, and format familiar to U.S. investors.

Similar to domestically traded stock, U.S. investment banks underwrite and sell stock issues globally. For example, Aspreva Pharmaceuticals issued 8,280,000 of its common shares in March 2005; 5,865,000 were issued in the United States and 2,415,000 in international markets. An internationally placed stock issue is attractive to an issuing firm because the shares of stock can reach a much larger market than if they were placed strictly in the United States. Foreign investors (with investment needs that differ from U.S. investors) may buy these stocks even when U.S. investors may not. Foreign issues of stock can also help enhance the international reputation of the firm. This is especially important to firms that concentrate at least a part of their business in international trade.

As noted earlier, U.S. stock exchanges are regulated by the SEC on some matters and are self-regulated organizations for others. Stock market structures in Japan, Canada, Hong Kong, and Australia are similar to the U.S. structure. These exchanges are self-regulating, with the government mainly playing the role of monitor. In Canada, Hong Kong, and Australia, the exchanges determine which securities are listed and the criteria that firms must meet for membership. In Japan, the Ministry of Finance must approve all listed securities.

In France, Belgium, Spain, and Italy, governments exercise the major control over the operations and activities of the exchanges. Membership on these exchanges may require government approval or licensing, and to insure against insolvency government agencies set minimum capital requirements. In Germany, Switzerland, Austria, and Sweden, the majority of the exchange trading is conducted through banks, reflecting regulatory and government policy.

As mentioned earlier, prices on U.S. stock markets are determined continuously throughout the trading day as brokers submit orders. Stock markets in Canada, Japan, Hong Kong, and most of Europe also use continuous trading. Stock markets in Germany and Austria use call-based trading, in which orders are batched for simultaneous execution at the same price and at a particular time during the day.

Only the Montreal Stock Exchange uses a specialist system of trading directly similar to that of the NYSE. The Amsterdam Stock Exchange gives certain firms the specialists duties for small and medium-sized trades. Large trades, however, are transacted directly by

the parties involved. On the Toronto Stock Exchange, market makers are similar to specialists. These traders are selected by the exchange to trade for their own accounts and to create an orderly price flow in stocks that the exchange assigns them. These traders are obligated to post bid and ask prices throughout the day and to keep their bid-ask spreads small.

All other continuous trading markets in the world use a competitive dealer system of trading similar to that used by NASDAQ. For example, the London International Stock Exchange allows any well-capitalized firm that follows the regulations to act as a dealer for any security. Market makers publish firm bid-ask quotes for their stocks. One difference in this market is that for a limit order, only the broker-dealer that accepts the order from a customer knows about it. The computerized trading system does not record the existence of an order. The dealer then executes the order when his or her own price reaches the requested level. The Tokyo Stock Exchange uses a variation of the competitive dealer system, in which a broker functions as an intermediary between the dealers and the brokers who are members of the exchange. The brokers cannot buy or sell for their own accounts but can only arrange transactions among dealers, conduct trading auctions, and match buy and sell orders submitted by brokers for their clients.

DO YOU UNDERSTAND?

SUMMARY

In this chapter, we examined corporate stocks and stock markets. Holders of corporate (preferred and common) stock have an ownership interest in the issuing firm based on the percentage of stock held. Stock markets are the most watched and reported of the financial markets. We described the major characteristics of corporate stocks—for example, dividend rights, residual claim status, limited liability, and voting rights of stockholders. We also looked at the primary and secondary markets for stocks, including a description of the trading process. While the NYSE has historically been the major stock market exchange in the United States, we showed that the NASDAQ system is increasing in importance.

We also looked at stock market indexes as predictors of future economic activity, reviewed the speed with which stock market prices adjust to new information, and described the major regulations governing stock market trading. We concluded the chapter with a brief look at international stock market activity—foreign investments in U.S. corporate stocks and U.S. investments in foreign corporate stocks.

SEARCH THE SITE

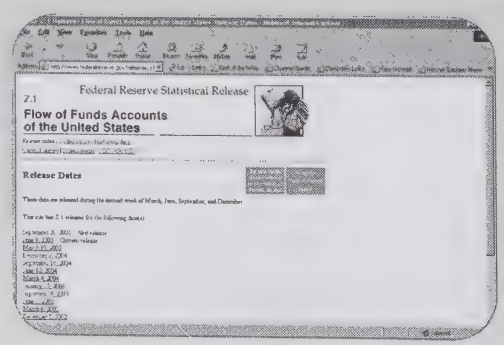
Go to the Federal Reserve Board's Web site and find the most recent data on the market value of common stock outstanding, by type of issue and by holder.

Go to the Federal Reserve Board's Web site at **www.federalreserve.gov/releases/Z1**

Click on the most recent date.

Click on "Level Tables"

This will download a file onto your computer that will contain the data on the market value of common stock outstanding, Table L213.



Questions

1. What is the market value of common stock currently outstanding? Calculate the percentage change in this value since 2004, reported in Figure 9–1.
2. What is the percentage of common stock outstanding issued by nonfinancial corporate businesses, financial corporations, and the rest of the world?

QUESTIONS

1. Why are the stock markets the most watched and reported of the financial security markets?
2. What are some characteristics associated with dividends paid on common stock?
3. What is meant by the statement "common stockholders have a residual claim on the issuing firm's assets"?
4. What is a dual-class firm? Why do firms typically issue dual classes of common stock?
5. Suppose a firm has 15 million shares of common stock outstanding and six candidates are up for election to five seats on the board of directors.
   a. If the firm uses cumulative voting to elect its board, what is the minimum number of votes needed to ensure election to the board?
   b. If the firm uses straight voting to elect its board, what is the minimum number of votes needed to ensure election to the board?
6. What is the difference between nonparticipating and participating preferred stock?
7. What is the difference between cumulative and noncumulative preferred stock?
8. Suppose you own 50,000 shares of common stock in a firm with 2.5 million total shares outstanding. The firm announces a plan to sell an additional 1 million shares through a rights offering. The market value of the stock is $35 before the rights offering and the new shares are being offered to existing shareholders at a $5 discount.
   a. If you exercise your preemptive rights, how many of the new shares can you purchase?
   b. What is the market value of the stock after the rights offering?
   c. What is your total investment in the firm after the rights offering? How is your investment split between original shares and new shares?
   d. If you decide not to exercise your preemptive rights, what is your investment in the firm after the rights offering? How is this split between oldshares and rights?
9. What have been the trends in the growth of the NYSE, AMEX, and NASDAQ stock market exchanges?
10. What is a market order? What is a limit order? How are each executed?
11. Refer to the stock market quote in Table 9–3.
    a. What was the closing stock price for Anheuser-Busch Corp. on December 30, 2004?
    b. What were the high and low prices at which Ann Taylor stores traded between December 31, 2003 and December 30, 2004?
    c. What was the dividend yield on Archer Daniels Midland stock as of December 30, 2004?
12. STANDARD &POOR'S Go to the S&P Markets Insight Web site and find stock market data for Pfizer Inc. (PFE) using the following steps. Go to the S&P Educational Version of Market Insight Web site at **www.mhhe.com/edumarketinsight.** Click on "Educational Version of Market Insight." Enter your site ID and click on "Login." Click on "Company." In the box marked "Ticker" enter PFE and click on "Go!" Under Compustat Reports click on "Company Profile." This brings up a file that contains the relevant data.
13. STANDARD &POOR'S Go to the S&P Market Insight Web site and find forecasted stock prices for Microsoft Corp. (MSFT) using the following steps. Go to the S&P Educational Version of Market Insight Web site at **www.mhhe.com/edumarketinsight.** Click on "Educational Version of Market Insight." Enter your site ID and click on "Login." Click on "Company." In the box marked "Ticker" enter MSFT and click on "Go!" Click on "Exel Analytics." Click on "Forecasted Vals." This brings up a file that contains the relevant data.
14. eXcel **Using a Spreadsheet to Calculate Stock Returns:** At the beginning of the year, you purchased a share of stock for $50. Over the year the dividends paid on the stock were $4.50 per share. Calculate the return on a stock if the price of the stock at the end of the year is $40, $48, $50, and $55.

Price at Beginning of Year	Dividends	Price at End of Year	=> The Return Is
$50	$4.50	$40	–11.00%
50	4.50	48	5.00
50	4.50	50	9.00
50	4.50	55	19.00

15. What are the major U.S. stock market indexes?
16. Who are the major holders of corporate stock?
17. STANDARD &POOR'S Go to the S&P Market Insight Web site and look up the industry profile for Consumer Electronics using the following steps. Go to the S&P Educational Version of Market Insight Web site at **www.mhhe.com/edumarketinsight.** Click on "Educational Version of Market Insight." Enter your site ID and click on "Login." Click on "Industry." Under Industry select Consumer Electronics and click on "Go!" Click on "GICS Sub-Industry Profile." This brings up a file that contains the relevant data. How does this industry's performance compare to the S&P 500 Index?
18. Are stock market indexes consistently accurate predictors of economic activity?
19. Describe the three forms of stock market efficiency.
20. What are circuit breakers used by the NYSE?
21. What is an ADR? How is an ADR created?

APPENDIX 9A: The Capital Asset Pricing Model

View this appendix at
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APPENDIX 9B: Event Study Tests

View this appendix at
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Chapter 8

Derivative Securities Markets

OUTLINE

Chapter NAVIGATOR

1. What are forward and future contracts?
2. How is a futures transaction conducted?
3. What information can be found in a futures quote?
4. What are option contracts?
5. What information can be found in an options quote?
6. Who are the main regulators of futures and options markets?
7. What is an interest rate swap?
8. What are caps, floors, and collars?
9. What are the biggest derivative securities markets globally?

DERIVATIVE SECURITIES: CHAPTER OVERVIEW

A **derivative security** is a financial security whose payoff is linked to another, previously issued security. Derivative securities generally involve an agreement between two parties to exchange a standard quantity of an asset or cash flow at a predetermined price and at a specified date in the future. As the value of the underlying security to be exchanged changes, the value of the derivative security changes. A securitized asset such as a mortgage-backed security (see Chapter 7) is a derivative security in that its value is based on the value of an underlying security (e.g., a mortgage). Option contracts are also derivatives since their value depends on the price of some underlying security (e.g., a stock) relative to a reference (or strike) price. **Derivative securities markets** are the markets in which derivative securities trade. While derivative securities have been in existence for centuries, the growth in derivative securities markets occurred mainly in the 1970s, 1980s, and 1990s. As major markets, therefore, the derivative securities markets are the newest of the financial security markets.

derivative security
An agreement between two parties to exchange a standard quantity of an asset at a predetermined price at a specified date in the future.

derivative securities markets
The markets in which derivative securities trade.

www.cme.com

www.federalreserve.gov

www.cbot.com

The first of the modern wave of derivatives to trade were foreign currency futures contracts. These contracts were introduced by the International Monetary Market (IMM), a subsidiary of the Chicago Mercantile Exchange (CME), in response to the introduction of floating exchange rates between currencies of different countries following the Smithsonian Agreements of 1971 and 1973 (see Chapter 8).

The second wave of derivative security growth was with interest rate derivative securities. Their growth was mainly in response to increases in the volatility of interest rates in the late 1970s and after, as the Federal Reserve started to target nonborrowed reserves (see Chapter 4) rather than interest rates. Financial institutions such as banks and savings institutions had many rate-sensitive assets and liabilities on their balance sheets. As interest rate volatility increased, the sensitivity of the net worth (equity) of these institutions to interest rate shocks increased as well. In response, the Chicago Board of Trade (CBT) introduced, in the 1970s, numerous short-term and long-term interest rate futures contracts, and in the 1980s, stock index futures and options. Accordingly, financial institutions are the major participants in the derivative securities markets. Financial institutions can be either users of derivative contracts for hedging (see Chapter 23) or dealers that act as counterparties in trades with customers for a fee. Approximately 640 U.S. banks use derivatives and only five large dealer banks—J. P. Morgan Chase, Bank of America Corp., Citigroup Inc., First Union Corp., and Wells Fargo—account for some 95 percent of the derivatives that user banks hold.[1]

A third wave of derivative security innovations occurred in the 1990s with credit derivatives (e.g., credit forwards, credit risk options, and credit swaps). For example, a credit forward is a forward agreement that hedges against an increase in default risk on a loan (a decline in the credit quality of a borrower) after the loan rate is determined and the loan is issued. In September 2004, the notional value of credit derivatives held by U.S. banks was approximately $1,909 billion. These derivative securities have become particularly useful for managing credit risk of emerging-market countries and credit portfolio risk in general.[2]

In addition to trading on traditional exchanges such at the CME and the CBT (which maintain "open outcry" trading pits, where trading is conducted using hand waving and shouting), the early 2000s saw the rise in derivative trading on electronic exchanges. For example, in October 2004, the CME announced the billionth trade on its Globex electronic trading platform. In the third quarter of 2004, electronic trading of derivative security was 61 percent of total volume, up from 52 percent in the second quarter of 2004. In 2004 Eurex, the world's largest derivatives exchange, launched a fully electronic exchange in the United States. Based in Chicago, this exchange offers futures and options on U.S. Treasury notes and 30-year Treasury bonds as well as 2-, 5-, and 10-year contracts on euro interest rate contracts. The CBT, concerned that its Treasury contracts were under threat, introduced improved technology of its own, reduced transaction costs, and established a new common trading link with the CME.

In this chapter, we present an overview of the derivative securities markets. We look at the markets for forwards, futures, options, swaps, and some special derivative contracts (caps, floors, and collars). We define the various derivative securities and focus on the markets themselves—their operations and trading processes. In Chapter 23, we describe how these securities can be used to manage and hedge the foreign exchange, interest rate, and credit risks of financial institutions.

FORWARDS AND FUTURES

1

To present the essential nature and characteristics of forward and futures contracts and markets, we compare them with spot contracts. We define each in Table 10–1.

1. See Office of the Comptroller of the Currency, "Bank Derivatives Report," Third Quarter, September 2004.

2. Enron Corp. was among the top 20 dealers in the credit derivatives market in the early 2000s. Enron's derivatives trading liabilities to third parties were estimated at around $18.7 billion in late 2001. In fact, Enron's extensive use of credit derivatives, not just its accounting practices, may lie at the root of the energy giant's slide into the largest bankruptcy in U.S. history. Enron used profits from its credit derivatives trading operation to mask losses in its other businesses. Enron made billions trading derivatives, but lost billions on virtually everything else it did.

TABLE 10–1 Spot, Forward, and Futures Contracts

Spot Contract—agreement made between a buyer and a seller at time 0 for the seller to deliver the asset immediately and the buyer to pay for the asset immediately.

Forward Contract—agreement between a buyer and a seller at time 0 to exchange a nonstandardized asset for cash at some future date. The details of the asset and the price to be paid at the forward contract expiration date are set at time 0. The price of the forward contract is fixed over the life of the contract.

Futures Contract—agreement between a buyer and a seller at time 0 to exchange a standardized asset for cash at some future date. Each contract has a standardized expiration and transactions occur in a centralized market. The price of the futures contract changes daily as the market value of the asset underlying the futures fluctuates.

Spot Markets

spot contract

An agreement to transact involving the immediate exchange of assets and funds.

A **spot contract** is an agreement between a buyer and a seller at time 0, when the seller of the asset agrees to deliver it immediately and the buyer agrees to pay for that asset immediately.[3] Thus, the unique feature of a spot market is the immediate and simultaneous exchange of cash for securities, or what is often called *delivery versus payment*. A spot bond quote of $97 for a 20-year maturity bond is the price the buyer must pay the seller, per $100 of face value, for immediate (time 0) delivery of the 20-year bond.

Spot transactions occur because the buyer of the asset believes its value will increase in the immediate future (over the investor's holding period). If the value of the asset increases as expected, the investor can sell the asset at its higher price for a profit. For example, if the 20-year bond increases in value to $99 per $100 of face value, the investor can sell the bond for a profit of $2 per $100 of face value.

Forward Markets

forward contract

An agreement to transact involving the future exchange of a set amount of assets at a set price.

Forward Contracts. A **forward contract** is a contractual agreement between a buyer and a seller at time 0 to exchange a prespecified asset for cash at some later date. Market participants take a position in forward contracts because the future (spot) price or interest rate on an asset is uncertain. Rather than risk that the future spot price will move against them—that the asset will become more expensive to buy in the future—forward traders pay a financial institution a fee to arrange a forward contract. Such a contract lets the market participant hedge the risk that future spot prices on an asset will move against him or her by guaranteeing a future price for the asset *today*.

For example, in a three-month forward contract to deliver $100 face value of 10-year bonds, the buyer and seller agree on a price and amount today (time 0), but the delivery (or exchange) of the 10-year bond for cash does not occur until three months into the future. If the forward price agreed to at time 0 was $98 per $100 of face value, in three months' time the seller delivers $100 of 10-year bonds and receives $98 from the buyer. This is the price the buyer must pay and the seller must accept no matter what happens to the spot price of 10-year bonds during the three months between the time the contract was entered into and the time the bonds are delivered for payment (i.e., whether the spot price falls to $97 or below or rises to $99 or above).

In Chapter 8, we discussed the market for forward foreign currency exchange contracts, which allows market participants to buy or sell a specified currency for a specified price at a specified date (e.g., one-month, three-month, or six-month contracts are standard).

3. Technically, physical settlement and delivery may take place one or two days after the contractual spot agreement in bond markets. In equity markets, delivery and cash settlement normally occurs three business days after the spot contract agreement ($T + 3$ settlement).

Forward contracts can also be based on a specified interest rate (e.g., LIBOR) rather than a specified asset (called forward rate agreements, or FRAs). The buyer of an FRA agrees to pay the contract rate based on some notional principal amount (e.g., $1 million)—he or she buys the notional amount at the stated interest rate. The seller of an FRA agrees to sell the funds to the buyer at the stated rate. For example, for a three-month FRA written today with a notional value of $1 million and a contract rate of 5.70 percent, the buyer of the FRA agrees to pay 5.70 percent (the current three-month LIBOR rate) to borrow $1 million starting three months from now. The seller of the FRA agrees to lend $1 million to the buyer at 5.70 percent starting three months from now. If interest rates rise in the next three months, the FRA buyer benefits from the FRA. He or she can borrow $1 million at the rate stated on the FRA (5.70 percent) rather than the higher market rate (say, 7 percent).

Forward contracts often involve underlying assets that are nonstandardized, because the terms of each contract are negotiated individually between the buyer and the seller (e.g., a contract between Bank A to buy from Bank B, six months from now, $1 million in 30-year Treasury bonds with a coupon rate of 6.25 percent). As a result, the buyer and seller involved in a forward contract must locate and deal directly with each other in the over-the-counter market to set the terms of the contract rather than transacting the sale in a centralized market (such as a futures market exchange).

Forward Markets. Commercial banks (see Chapter 11) and investment banks and broker-dealers (see Chapter 16) are the major forward market participants, acting as both principals and agents. These financial institutions make a profit on the spread between the price at which they buy and sell the asset underlying the forward contracts.

Each forward contract is originally negotiated between the financial institution and the customer, and therefore the details of each (e.g., price, expiration, size, delivery date) can be unique. As the forward market has grown over the last decade, however, traders have begun making secondary markets in some forward contracts, communicating the buy and sell price on the contracts over computer networks. As of September 2004, U.S. commercial banks held over $8.15 trillion of forward contracts that were listed for trading in the over-the-counter markets. The advent of this secondary market trading has resulted in an increase in the standardization of forward contracts. It has also become increasingly easy to get out of a forward position by taking an offsetting forward position in the secondary market. Secondary market activity in forward contracts has made them more attractive to firms and investors that had previously been reluctant to get locked into a forward contract until expiration. Secondary market activity has also resulted in a situation in which the differences between forward and future contracts have significantly narrowed.

Futures Markets

futures contract

An agreement to transact involving the future exchange of a set amount of assets for a price that is settled daily.

marked to market

Describes the prices on outstanding futures contracts that are adjusted each day to reflect current futures market conditions.

Futures Contracts. A **futures contract** is normally traded on an organized exchange such as the New York Futures Exchange (NYFE). A futures contract, like a forward contract, is an agreement between a buyer and a seller at time 0 to exchange a standardized, prespecified asset for cash at some later date. Thus, a futures contract is very similar to a forward contract. One difference between forwards and futures is that forward contracts are bilateral contracts subject to counterparty default risk, but the default risk on futures is significantly reduced by the futures exchange guaranteeing to indemnify counterparties against credit or default risk. Another difference relates to the contract's price, which in a forward contract is fixed over the life of the contract (e.g., $98 per $100 of face value for three months to be paid on expiration of the forward contract), whereas a futures contract is **marked to market** daily. This means that the contract's price is adjusted each day as the futures price for the contract changes and the contract approaches expiration. Therefore, actual daily cash settlements occur between the buyer and seller in response to these price changes (this is called marking-to-market). This can be compared to a forward contract, for which cash payment from buyer to seller occurs only at the end

initial margin

A deposit required on futures trades to ensure that the terms of any futures contract will be met.

maintenance margin

The margin a futures trader must maintain once a futures position is taken. If losses on the customer's futures position occur and the level of the funds in the margin account drop below the maintenance margin, the customer is required to deposit additional funds into his or her margin account, bringing the balance back up to the initial margin.

leveraged investment

An investment in which traders post and maintain only a small portion of the value of their futures position in their accounts. The vast majority of the investment is borrowed from the investor's broker.

of the contract period. Marking these contracts to market ensures that both parties to the futures contract maintain sufficient funds in their account to guarantee the eventual payoff when the contract matures. For the buyers of the futures contract, marking to market can result in unexpected payments from their account if the price of the futures contract moves against them.

Brokerage firms require their customers to post only a portion of the value of the futures contracts, called an **initial margin,** any time they request a trade. The amount of the margin varies according to the type of contract traded and the quantity of futures contracts traded (e.g., 5 percent of the value of the underlying asset). Minimum margin levels are set by each exchange. If losses on the customer's futures position occur (when their account is marked to market at the end of the trading day) and the level of the funds in the margin account drops below a stated level (called the **maintenance margin**), the customer receives a margin call. A margin call requires the customer to deposit additional funds into his or her margin account, bringing the balance back up to the initial level. The maintenance margin is generally about 75 percent of the initial margin. If the margin is not maintained, the broker closes out (sells) the customer's futures position. Any amount of cash received above the initial margin may be withdrawn by the customer from his or her account. Brokerage firms are responsible for ensuring that their customers maintain the required margin requirements.

Because futures traders must post and maintain only a small portion of the value of their futures position in their accounts (e.g., 4 percent of the value of the contracts), these **investments** are highly **leveraged.** That is, the vast majority of the investment is "borrowed" from the investor's broker. This high degree of leverage, combined with the marking to market feature of these contracts, can require the payment of large, unexpected cash flows from the investor to the broker if the price of the futures contracts moves against the investor.

EXAMPLE 10–1 The Impact of Marking to Market and Margin Requirements on Futures Investments

Suppose an investor has a $1 million position in T-bond futures. The investor's broker requires a maintenance margin of 4 percent, or $40,000 ($1m. × .04), which is the amount currently in the investor's account. Suppose also that the value of the futures contracts drops by $50,000 to $950,000. The investor will now be required to hold $38,000 ($950,000 × .04) in his account (or he has a $2,000 surplus). Further, because futures contracts are marked to market, the investor's broker will make a margin call to the investor requiring him to immediately send a check for $50,000 − $2,000, or $48,000, leaving him with an account balance of $38,000 at his broker for the $950,000 T-bond future position. Thus, as stated above, the marking to market feature of futures contracts can lead to unexpected cash outflows for a futures investor.

In a futures contract, like a forward contract, a person or firm makes a commitment to deliver an asset (such as foreign exchange) at some future date. If a counterparty were to default on a futures contract, however, the exchange would assume the defaulting party's position and payment obligations. Consider the case of Barings, the 200-year-old British merchant bank that failed as a result of trading losses in February 1995. In this case, Barings (specifically, one trader, Nick Leeson) bought $8 billion worth of futures on the Japanese Nikkei Stock Market Index, betting that the Nikkei index would rise. For a number of reasons, the index actually fell and the bank lost more than $1.2 billion on its trading position over a period of one month. When Barings was unable to meet its margin calls on Nikkei Index futures traded on the Singapore futures exchange (SIMEX)

ETHICAL DEBATES

www.dunhill.tv.com/powerweb

Big Australian Bank Widens Probe

Widening its investigation into a rogue-trading scandal, National Australia Bank Ltd. said foreign-currency trading losses could rise to as much as 600 million Australian dollars ($485 million). The big Australian bank's Chief Executive Frank Cicutto ordered that a probe into unauthorized trading of foreign-currency options be expanded into other market operations, such as commodities, spot currency, and interest rates. While the focus continues to be on bogus trades from its foreign-currency options desk, NAB hopes the broader review of its entire trading floor will inject confidence into its market operation.

Details of the wider investigation emerged as NAB raised its estimate of a pretax loss arising from unauthorized foreign-currency options trades since October by A$5 million to A$185 million. Analysis already expect known losses to wipe out the bank's entire fiscal 2004 earnings growth . . . Four NAB employees were suspended last week in connection with the allegations of unauthorized trading. The federal police and bank-sector regulators also are investigating.

Source: *The Wall Street Journal*, January 20, 2004, p. A12, by Erick Johnston. **www.wsj.com**

in 1995, the exchange stood ready to assume Barings' futures contracts and ensure that no counterparty lost money. Thus, unless a systematic financial market collapse threatens an exchange itself, futures are essentially default risk free. In addition, the default risk of a futures contract is less than that of a forward contract for at least four reasons: (1) daily marking to market of futures (so that there is no buildup of losses or gains), (2) margin requirements on futures that act as a security bond should a counterparty default, (3) price movement limits that spread extreme price fluctuations over time, and (4) default guarantees by the futures exchange itself. The Ethical Debates box highlights a more recent example of a rogue trader's actions that led to large losses at National Australia Bank.

DO YOU UNDERSTAND?

Futures Markets. Futures trading occurs on organized exchanges—for example, the Chicago Board of Trade (CBT) and the Chicago Mercantile Exchange (CME). Financial futures market trading was introduced in 1972 with the establishment of foreign exchange future contracts on the International Money Market (IMM). By 2005, five major exchanges existed in the United States[4] and several exchanges exist abroad.[5] Table 10–2 lists the characteristics of some of the most widely traded financial futures contracts. Table 10–3 lists the average month-end contracts outstanding, number of contracts traded, and number of contracts settled from 1992 through 2003. The terms of futures contracts (e.g., contract size, delivery month, trading hours, minimum price fluctuation, daily price limits, and process used for delivery) traded in the United States are set by the exchange and are subject to the approval of the Commodity Futures Trading Commission (CFTC), the principal regulator of futures markets. For example, the contract terms for 30-year T-bond futures are listed in Table 10–4.

www.cbot.com

www.cme.com

www.cftc.gov

In recent years, "off-market" trading systems have sprung up in which institutional investors and money managers can continue to trade during, as well as after, futures exchanges operating hours. Indeed, trading volume in off-market currencies, interest rate swaps, and Eurodollars has grown an estimated 3 to 10 times faster than trading volume on futures exchanges.

4. These include the Chicago Board of Trade, the Chicago Mercantile Exchange, the New York Futures Exchange, the MidAmerica Commodity Exchange, and the Kansas City Board of Trade.

5. These include the London International Financial Futures Exchange (LIFFE), the Singapore Exchange (SGX), the Marchè a Terme International de France (MATIF), and the Montreal Exchange.

TABLE 10-2 Characteristics of Actively Traded Futures Contracts

Open Interest	Unit Size	Exchange*	Volume	Open Interest
Interest Rates				
Treasury bonds	$100,000	CBT		631,291
Treasury notes	$100,000	CBT		1,688,804
Treasury notes—5 year	$100,000	CBT		1,146,364
Treasury notes—2 year	$200,000	CBT		265,181
Federal funds—30 days	$5,000,000	CBT		342,948
Eurodollars	$1,000,000	CME		7,062,495
Short sterling	£500,000	LIFFE		1,317,857
Eurolibor-3 month	Euro 1,000,000	LIFFE		2,731,469
Euroswiss-3 month	Sfr 1,000,000	LIFFE		265,205
Canadian banker's acceptances	C$1,000,000	ME		291,712
Commonwealth T-bonds—3 year	A$100,000	SFE		328,388
Euroyen	¥100,000,000	SGX		343,003
German Euro-government bonds—5 year	Euro 100,000	EUREX		759,612
German Euro-government bonds—10 year	Euro 100,000	EUREX		1,209,789
Currency				
Japanese yen	¥12,500,000	CME		157,988
Canadian dollar	C$100,000	CME		70,945
British pound	£62,500	CME		67,679
Swiss franc	Sfr 125,000	CME		53,537
Australian dollar	A$100,000	CME		64,094
Euro FX	Euro 125,000	CME		141,853
Index				
DJIA	$10 times average	CBT		48,135
S&P 500 index	$250 times index	CME		683,891
Mini S&P index	$50 times index	CME		832,200
Nasdaq 100	$100 times index	CME		66,075
Mini Nasdaq100	$20 times index	CME		320,564
Russell 1000	$500 times index	NYBOT		74,899
Share price index	A$25 times index	SFE		160,405
CAC-40 stock index	Euro 10 times index	MATIF		480,167
FT-SE 100 index	£10 times index	LIFFE		466,212
DJ Euro Stoxx 50 index	Euro 10 times index	EUREX		1,491,682

*CBT = Chicago Board of Trade, CME = Chicago Mercantile Exchange, LIFFE = London International Financial Futures Exchange, ME = Montreal Exchange, MATIF = Marchè a Terme International de France, SFE = Sydney Futures Exchange, SGX = Singapore Exchange Ltd., EUREX = The European Derivatives Market.

Source: *The Wall Street Journal*, January 10, 2005, p. C11. Reprinted by permission of *The Wall Street Journal*. **www.wsj.com**

open-outcry auction

Method of futures trading where traders face each other and "cry out" their offer to buy or sell a stated number of futures contracts at a stated price.

Trading on the largest exchanges such as the CBT takes place in trading "pits." A trading pit consists of circular steps leading down to the center of the pit. Traders for each delivery date on a futures contract informally group together in the trading pit. Futures trading occurs using an **open-outcry auction** method where traders face each other and "cry out" their offers to buy or sell a stated number of futures contracts at a stated price.

TABLE 10–3 Futures Market Activity, 1992–2003

	1992	1995	2000	2003
Average month end contracts outstanding (in thousands):				
Financial instruments	2,037.8	3,749.8	5,454.9	9,117.1
Currencies	385.5	299.2	402.7	499.0
Number of contracts traded (in millions):				
Financial instruments	148.2	259.0	297.0	760.3
Currencies	38.7	24.3	20.0	30.0
Number of contracts maturing (in thousands):				
Financial instruments	965.4	1,939.9	3,151.5	7,115.8
Currencies	503.1	521.5	722.3	682.1

Source: Commodity Futures Trading Commission, January 2000 and 2005. **www.cftc.gov**

floor broker
Exchange members who place trades from the public.

professional traders
Exchange members who trade for their own account.

position traders
Exchange members who take a position in the futures market based on their expectations about the future direction of the prices of the underlying assets.

day traders
Exchange members who take a position within a day and liquidate it before day's end.

scalpers
Exchange members who take positions for very short periods of time, sometimes only minutes, in an attempt to profit from this active trading.

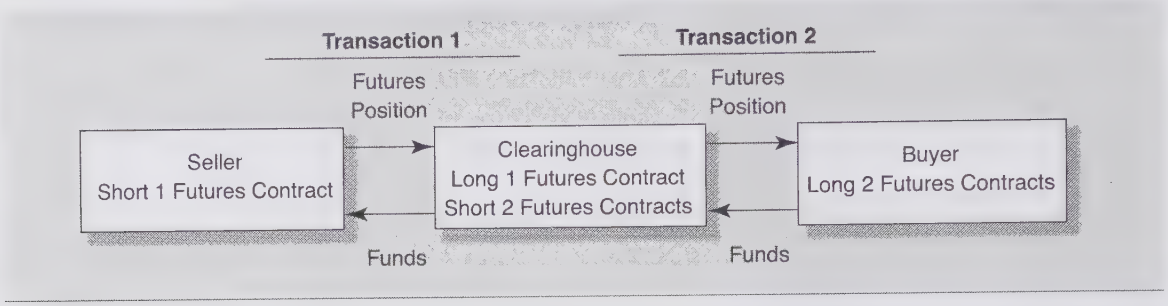
Only futures exchange members are allowed to transact on the floor of futures exchanges. Trades from the public are placed with a **floor broker.** When an order is placed, a floor broker may trade with another floor broker or with a professional trader. **Professional traders** are similar to specialists on the stock exchanges in that they trade for their own account. Professional traders are also referred to as position traders, day traders, or scalpers. **Position traders** take a position in the futures market based on their expectations about the future direction of prices of the underlying assets. **Day traders** generally take a position within a day and liquidate it before day's end. **Scalpers** take positions for very short periods of time, sometimes only minutes, in an attempt to profit from this active trading. Scalpers do not have an affirmative obligation to provide liquidity to futures markets but do

TABLE 10–4 Contract Terms for 30-Year Treasury Bond Futures

Trading Unit: One U.S. Treasury bond having a face value at maturity of $100,000.
Deliverable Grades: U.S. Treasury bonds that, if callable, are not callable for at least 15 years from the first day of the delivery month or, if not callable, have a maturity of at least 15 years from the first day of the delivery month. The invoice price equals the futures settlement price times a conversion factor plus accrued interest. The conversion factor is the price of the delivered bond ($1 par value) to yield 6 percent.
Tick Size: 1/32 of a point ($31.25/contract); par is on the basis of 100 points.
Price Quote: Points ($1,000) and thirty-seconds of a point; for example 80-16 equals $80^{16}/_{32}$.
Contract Months: March, June, September, December.
Last Trading Day: Seventh business day preceding the last business day of the delivery month.
Last Delivery Day: Last business day of the delivery month.
Delivery Method: Federal Reserve book-entry wire-transfer system.
Trading Hours: Open Outcry—7:20 a.m.–2:00 p.m. Chicago time, Mon.–Fri.
Electronic—7:00 p.m.–4:00 p.m. Chicago time Sun.-Fri.
Trading in expiring contracts closes at noon (Chicago time) on the last trading day.
Ticker Symbols: Open Auction—US
Electronic—ZB
Daily Price Limit: None.

Source: Chicago Board of Trade Web site, January 2005. **www.cbot.com**

FIGURE 10–1 Clearinghouse Function in Futures Markets



so in expectation of earning a profit. Scalpers' profits are related to the bid-ask spread and the length of time a position is held. Specifically, it has been found that scalper trades held longer than three minutes, on average, produce losses to scalpers. Thus, this need for a quick turnover of a scalper's position enhances futures market liquidity and is therefore valuable.[6]

Similar to trading in the stock market, futures trades may be placed as market orders (instructing the floor broker to transact at the best price available) or limit orders (instructing the floor broker to transact at a specified price). The order may be for a purchase of the futures contract in which the futures holder takes a **long position** in the futures contract, or the order may be for a sale of the futures contract in which the futures holder takes a **short position** in the futures contract.

long position
A purchase of a futures contract.

short position
A sale of a futures contract.

Once a futures price is agreed upon in a trading pit, the two parties do not complete the deal with each other but rather (as illustrated in Figure 10–1) with the clearinghouse overseeing the exchange. The exchange's clearinghouse guarantees all trades made by exchange traders. The **clearinghouse** breaks up every trade into a buy and sell transaction and takes the opposite side of the transaction, becoming the buyer for every futures contract seller (transaction 1 in Figure 10–1) and the seller for every futures contract buyer (transaction 2 in Figure 10–1). Thus, the clearinghouse ensures that all trading obligations are met. Clearinghouses are able to perform their function as guarantor of an exchange's futures contracts by requiring all member firms to deposit sufficient funds (from customers' margin accounts) to ensure that the firm's customers will meet the terms of any futures contract entered into on the exchange.

clearinghouse
The unit that oversees trading on the exchange and guarantees all trades made by the exchange traders.

Table 10–5 shows a futures quote from *The Wall Street Journal* for January 10, 2005. The three types of financial futures contracts are interest rate futures, currency futures, and equity stock index futures. The underlying asset on an interest rate futures contract is a bond or a short-term fixed-interest security's price or interest rate (e.g., Treasury securities, Eurodollar CDs); on a currency contract it is an exchange rate (e.g., yen to U.S. dollar); and on an index futures contract it is a major U.S. or foreign stock market index (e.g., the Dow Jones Industrial Average—see Chapter 9). Look at the quote for Treasury bond interest rate futures contracts. The bold heading of each quote contains information about the underlying deliverable asset (e.g., Treasury bonds) on the futures contract, the exchange on which the futures is traded (e.g., CBT), the face value of a contract (e.g., $100,000), and the basis for the quoted prices (e.g., pts 32nds of 100%, or 112–11 = $112^{11}/_{32}$%). Each row of the quote provides information for a specific delivery month (e.g., Mar = March 2005). The first column of the quote lists the delivery month. The second through fourth columns, labeled OPEN, HIGH, and LOW, are the opening price,

6. See W.L. Silber, "Marketmaker Behavior in an Auction Market: An Analysis of Scalpers in Futures Markets," *Journal of Finance,* September 1984, pp. 937–53.

TABLE 10-5 Futures Quote

Interest Rate Futures

Treasury Bonds (CBT)-$100,000; pts 32nds of 100%

	OPEN	HIGH	LOW	SETTLE	CHG	LIFETIME HIGH	LIFETIME LOW	OPEN INT
Mar	113-00	113-15	112-00	112-13	8	114-02	100-25	612,141
June	111-16	111-20	111-16	111-16	8	113-07	100-00	18,941
Sept	109-31	109-31	109-31	110-26	8	111-02	109-31	195

Est vol 147,946; vol Fri 379,969; open int 631,291, +18,215.

Treasury Notes (CBT)-$100,000; pts 32nds of 100%

Mar	111-14	111-16	111-085	111-125	.5	113-165	104-315	1,651,790
June	110-185	110-20	110-13	110-16	.5	112-145	109-10	36,636
Sept	110-07	110-07	110-04	110-065	2.5	110-22	09-235	778

Est vol 427,231; vol Fri 958,424; open int 1,688,804, +38,116

5 Yr. Treasury Notes (CBT)-$100,000; pts 32nds of 100%

Mar	109-01	109-01	108-27	08-305	-1.0	110-275	108-27	1,121,833
June	108-17	108-17	08-155	08-155	-1.0	110-06	08-095	22,533

Est vol 245,270; vol Fri 558,876; open int 1,146,364, +13,173.

2 Yr. Treasury Notes (CBT)-$200,000; pts 32nds of 100%

Mar	04-165	04-175	104-15	04-147	-.7	05-022	04-147	265,181

Est vol 27,944; vol Fri 57,689; open int 265,181, +6,425.

30 Day Federal Funds (CBT)-$5,000,000; 100 - daily avg.

Jan	97.755	97.760	97.755	97.755	...	98.945	97.750	132,057
Feb	97.50	97.50	97.49	97.50	...	98.07	97.38	123,598
Mar	97.41	97.42	97.40	97.41	-.01	98.65	97.20	42,894
Apr	97.25	97.25	96.25	97.24	-.01	97.80	96.25	34,662
May	97.06	97.06	97.04	97.05	-.02	97.66	97.04	8,108
June	97.03	97.04	97.02	97.02	-.02	97.70	97.02	1,027

Est vol 24,662; vol Fri 39,814; open int 342,948, -887

10 Yr. Interest Rate Swaps (CBT)-$100,000; pts 32nds of 100%

Mar	110-02	110-03	109-26	109-30	1	111-19	108-09	36,142

Est vol 440; vol Fri 290; open int 36,142, -77.

10 Yr. Muni Note Index (CBT)-$1,000 x index

Mar	104-11	104-13	104-08	104-12	6	105-05	101-27	2,685

Est vol 332; vol Fri 717; open int 2,685, +531.

Index: Close 105-14; Yield 4.326.

Eurodollar (CME)-$1,000,000; pts of 100%

	OPEN	HIGH	LOW	SETTLE	CHG	YIELD	CHG	OPEN INT
1 Month Libor (CME)-$3,000,000; pts of 100%								
Jan	97.58	97.58	97.58	97.58	...	2.50		23,805
Feb	97.39	97.39	97.38	97.38	...	2.62		15,495
Mar	97.18	97.18	97.18	97.18	-.01	2.82	.01	5,646
Apr	97.02	97.02	97.02	97.02	-.02	2.98	.02	1,185

Est vol 1,921; vol Fri 2,994; open int 45,484, +1,309

Eurodollar (CME)-$1,000,000; pts of 100%								
Jan	97.34	97.34	97.33	97.33	...	2.67	...	74,450
Feb	97.18	97.18	97.18	97.18	...	2.82	...	8,826
Mar	97.06	97.06	97.03	97.04	-.01	2.96	.01	1,072,293
June	96.74	96.74	96.71	96.72	-.01	3.28	.01	1,167,365
Sept	96.48	96.49	96.44	96.47	-.01	3.53	.01	1,080,295
Dec	96.29	96.30	96.24	96.27	-.02	3.73	.02	807,486
Mr06	96.17	96.18	96.12	96.15	-.03	3.85	.01	603,527
June	96.08	96.08	96.03	96.06	-.01	3.94	.01	427,781
Sept	95.99	96.01	95.95	95.98	-.01	4.02	.01	312,914
Dec	95.90	95.93	95.86	95.89	-.01	4.11	.01	271,239
Mr07	95.83	95.85	95.79	95.82	-.01	4.18	.01	180,265
June	95.76	95.76	95.72	95.74	-.01	4.26	.01	160,047
Sept	95.68	95.69	95.65	95.67	-.01	4.33	.01	120,473
Dec	95.60	95.60	95.56	95.59	...	4.41	...	120,327
Mr08	95.53	95.54	95.50	95.52	...	4.48	...	96,701
June	95.45	95.46	95.43	95.44	...	4.56	...	101,718
Sept	95.37	95.38	95.35	95.36	...	4.64	...	95,510
Dec	95.28	95.28	95.26	95.27	...	4.73	...	85,283
Mr09	95.21	95.22	95.19	95.20	...	4.80	...	66,313
June	95.12	95.13	95.10	95.12	.01	4.88	-.01	59,362
Sept	95.04	95.05	95.02	95.04	.01	4.96	-.01	50,398
Dec	94.94	94.96	94.93	94.95	.01	5.05	-.01	29,002
Mr10	94.86	94.90	94.88	94.89	.01	5.11	-.01	13,739
June	94.81	94.83	94.81	94.83	.02	5.17	-.02	9,478
Sept	94.74	94.76	94.74	94.76	.03	5.24	-.03	7,788
Dec	94.65	94.67	94.65	94.67	.03	5.33	-.03	7,959
Mr11	94.60	94.62	94.60	94.62	.02	5.38	-.02	5,967
June	94.55	94.57	94.55	94.57	.02	5.43	-.02	5,432
Sept	94.50	94.52	94.50	94.52	.02	5.48	-.02	4,406
Dec	94.42	94.44	94.42	94.44	.03	5.56	-.03	2,010

Est vol 394,719; vol Fri 2,178,312; open int 7,062,495, +154,238.

	OPEN	HIGH	LOW	SETTLE	CHG	LIFETIME HIGH	LIFETIME LOW	OPEN INT
Euroyen (CME)-¥100,000,000; pts of 100%								
Mar	99.90	99.90	99.90	99.90	...	99.91	99.27	51,335
June	99.90	99.90	99.90	99.90	.01	99.90	99.16	33,651
Sept	99.86	99.86	99.86	99.86	...	99.87	98.98	7,736
Dec	99.82	99.82	99.82	99.82	.01	99.83	98.90	8,222
Mr06	99.75	99.76	99.75	99.76	.01	99.76	98.84	7,267

Est vol 2,733; vol Fri 41; open int 115,390, +781.

Short Sterling (LIFFE)-£500,000; pts of 100%

Jan	...	...	...	95.13	...	95.10	95.10	1,200
Mar	95.14	95.16	95.13	95.15	.01	96.38	93.29	238,562
June	95.20	95.26	95.20	95.24	.02	96.30	95.18	258,004
Sept	95.24	95.30	95.23	95.28	.02	96.23	94.06	243,955
Dec	95.24	95.30	95.22	95.28	.02	96.15	94.06	195,890
Mr06	95.19	95.28	95.19	95.26	.02	96.10	94.05	110,280
June	95.18	95.28	95.18	95.26	.03	95.97	94.04	98,941
Sept	95.20	95.27	95.20	95.25	.03	95.75	94.20	71,174
Dec	95.20	95.25	95.20	95.24	.03	95.83	94.21	43,451
Mr07	95.20	95.22	95.20	95.23	.03	95.82	94.20	23,310
June	95.20	95.22	95.20	95.22	.03	95.73	94.21	17,602
Sept	95.19	95.20	95.19	95.20	.03	95.62	94.21	10,080

Est vol 145,632; vol Fri 264,224; open int 1,317,857, +34,869.

Long Gilt (LIFFE)-£100,000; pts of 100%

Mar	111.65	111.88	111.60	111.83	.06	112.65	108.67	194,963

Est vol 26,064; vol Fri 59,539; open int 194,963, +1,958.

3 Month Euribor (LIFFE)-€1,000,000; pts of 100%

	OPEN	HIGH	LOW	SETTLE	CHG	LIFETIME HIGH	LIFETIME LOW	OPEN INT
Jan	97.86	97.86	97.86	97.86	...	97.86	97.76	34,561
Feb	...	...	...	97.85	...	97.85	97.74	11,530
Apr	97.78	97.81	97.78	97.80	...	97.81	97.74	1,952
May	97.74	97.79	97.74	97.76	...	97.79	97.70	300
June	97.69	97.73	97.69	97.72	.01	97.75	94.29	576,765
Sept	97.56	97.61	97.54	97.60	.02	97.71	94.29	370,415
Dec	97.42	97.47	97.40	97.46	.02	97.61	94.41	366,070
Mr06	97.32	97.38	97.30	97.36	.02	97.53	94.40	260,164
June	97.21	97.26	97.18	97.24	.02	97.42	94.66	229,568
Sept	97.10	97.15	97.06	97.14	.02	97.31	94.58	150,577
Dec	96.97	97.03	96.95	97.02	.02	97.16	94.62	98,816
Mr07	96.90	96.96	96.90	96.95	.03	97.07	94.57	48,159
June	96.82	96.89	96.82	96.88	.03	96.98	94.57	26,054
Sept	96.75	96.81	96.75	96.80	.03	96.88	95.26	23,951
Dec	96.66	96.71	96.66	96.71	.03	96.77	95.18	11,953
Mr08	96.62	96.66	96.62	96.67	.04	96.71	95.31	3,674
June	96.60	96.60	96.60	96.61	.04	96.60	95.32	1,940

Est vol 482,471; vol Fri 835,141; open int 2,731,469, +2,307.

3 Month Euroswiss (LIFFE)-CHF 1,000,000; pts of 100%

Mar	99.18	99.21	99.18	99.20	.01	99.23	97.90	187,480
June	99.00	99.05	98.99	99.03	.01	99.08	97.74	66,755
Sept	98.80	98.87	98.80	98.84	.02	98.95	97.75	48,253
Dec	98.63	98.71	98.63	98.67	.03	98.80	97.66	27,140
Mr06	98.52	98.57	98.52	98.54	.03	98.66	97.63	8,610
June	98.41	98.41	98.41	98.41	.04	98.54	97.51	4,145
Sept	98.28	98.28	98.28	98.29	.04	98.43	97.91	2,795

Est vol 33,028; vol Fri 16,383; open int 265,205, +2,853.

Canadian Bankers Acceptance (ME)-CAD 1,000,000

Mar	97.34	97.34	97.30	97.30	-0.03	97.34	94.45	101,617
June	97.14	97.14	97.09	97.09	-0.04	97.44	95.30	122,730
Sept	96.94	96.94	96.87	96.87	-0.06	97.25	95.21	42,954
Dec	96.73	96.73	96.67	96.67	-0.06	97.08	95.43	12,711
Mr06	96.50	96.52	96.49	96.49	-0.03	96.83	95.16	5,859
June	96.28	96.28	96.26	96.26	...	96.65	95.33	8,897

Est vol 43,729; vol Fri 75,467; open int 291,712, +36,788

10 Yr. Canadian Govt. Bonds (ME)-CAD 100,000

Mar	111.62	111.65	111.41	111.54	-0.83	112.76	110.05	127,435

Est vol 7,138; vol Fri 12,188; open int 127,435, +1,897

3 Yr. Commonwealth T-Bonds (SFE)-AUD 100,000

Mar	94.77	94.83	94.74	94.77	-0.01	95.11	94.65	328,188

Est vol 41,887; vol Fri 48,297; open int 328,188, +9,599.

Euroyen (SGX)-¥100,000,000; pts of 100%

Mar	99.90	99.90	99.90	99.90	0.01	99.91	99.28	103,013
June	99.90	99.90	99.89	99.90	0.01	99.90	99.10	94,727
Sept	99.86	99.86	99.86	99.86	0.01	99.87	98.95	45,033
Mr06	99.75	99.75	99.75	99.75		99.77	98.84	28,307

Est vol 1,118; vol Fri 3,903; open int 343,803, +1,353.

5 Yr. Euro-BOBL (EUREX)-€100,000; pts of 100%

Mar	113.13	113.33	113.07	113.22	0.06	113.76	110.63	742,492
June	112.31	112.51	112.31	112.42	0.06	112.82	111.26	17,128

vol Mon 497,761; open int 759,612, +4,621.

10 Yr. Euro-BUND (EUREX)-€100,000; pts of 100%

Mar	119.13	119.48	119.07	119.33	0.14	119.97	112.75	1,204,555
June	118.19	118.53	118.19	118.40	0.14	118.93	113.45	3,234

vol Mon 815,285; open int 1,209,789, -4,171.

2 Yr. Euro-SCHATZ (EUREX)-€100,000; pts of 100%

Mar	106.10	106.18	106.07	106.13	0.03	106.81	105.52	675,089

vol Mon 364,342; open int 675,263, +26,128.

Currency Futures

Japanese Yen (CME)-¥12,500,000; $ per ¥

Mar	.9580	.9651	.9580	.9641	.0072	.9885	.8873	137,751
June	na	.9717	.9699	.9711	.0072	.9917	.9040	20,084

Est vol 12,086; vol Fri 55,229; open int 157,988, -1,357.

Canadian Dollar (CME)-CAD 100,000; $ per CAD

Mar	.8111	.8208	.8101	.8184	.0072	.8526	.7150	66,547
June	.8179	.8211	.8112	.8195	.0072	.8495	.7159	3,896
Sept	.8150	.8206	.8190	.8200	.0072	.8490	.7160	768

Est vol 7,776; vol Fri 34,917; open int 70,945, +578.

British Pound (CME)-£62,500; $ per £

Mar	1.8678	1.8718	1.8625	1.8689	.0057	1.9446	1.7321	67,626

Est vol 4,890; vol Fri 14,667; open int 67,679, -6,192.

Swiss Franc (CME)-CHF 125,000; $ per CHF

Mar	.8468	.8510	.8461	.8485	.0018	.8892	.7853	53,358
June	...	...	...	.8529	.0018	.8920	.8529	132

Est vol 5,586; vol Fri 29,659; open int 53,537, +2,721.

Australian Dollar (CME)-AUD 100,000; $ per AUD

Mar	.7536	.7573	.7529	.7545	.0026	.7879	.6400	63,328
June	...	...	...	.7499	.0026	.7785	.6670	344

Est vol 1,898; vol Fri 15,414; open int 64,094, -2,895.

Mexican Peso (CME)-MXN 500,000; $ per MXN

Jan	...	...	...	.08882	.00030	.08910	.08770	63
Mar	.08772	.08802	.08755	.08797	.00030	.08890	.08200	68,521
June	.08665	.08665	.08665	.08670	.00030	.08735	.08160	1,243

Est vol 4,140; vol Fri 24,210; open int 70,189, +4,462.

Euro/US Dollar (CME)-€125,000; $ per €

Mar	1.3063	1.3132	1.3051	1.3098	.0036	1.3687	1.1363	139,081
June	1.3124	1.3155	1.3107	1.3122	.0036	1.3699	1.1750	1,388

Est vol 46,172; vol Fri 204,156; open int 141,853, +2,394.

Euro/US Dollar (NYBOT)-€200,000; $ per €

Mar	...	...	...	1.3180	.0034	1.3643	1.2930	449

Est vol 425; vol Fri 327; open int 449, +22.

Euro/Japanese Yen (NYBOT)-€100,000; ¥ per €

Mar	136.30	136.45	135.79	135.79	-.67	140.94	135.79	19,713

Est vol 5,304; vol Fri 6,315; open int 19,713, -1,585.

Euro/British Pound (NYBOT)-€100,000; £ per €

Mar	.7010	.7016	.7008	.7011	-.0003	.7140	.6892	6,107

Est vol 465; vol Fri 658; open int 6,109, -42.

Index Futures

DJ Industrial Average (CBT)-$10 x index

	OPEN	HIGH	LOW	SETTLE	CHG	LIFETIME HIGH	LIFETIME LOW	OPEN INT
Mar	10614	10672	10585	10628	29	10875	9720	48,094

Est vol 4,271; vol Fri 7,582; open int 48,135, -773.

Idx pri: Hi 10663.74; Lo 10582.38; Close 10621.03, +37.07.

Mini DJ Industrial Average (CBT)-$5 x index

Mar	10613	10673	10585	10628	29	10870	9705	53,812

Vol Mon 96,267; open int 53,837, -1,511.

DJ-AIG Commodity Index (CBT)-$100 x index

Jan	...	...	...	486.2	1.3	507.5	464.9	670

Est vol 464; vol Fri 54; open int 697, +22.

Idx pri: Hi 146.670; Lo 144.384; Close 144.572, +.360.

S&P 500 Index (CME)-$250 x index

Mar	118710	119670	118550	119170	540	122120	84350	661,690
June	119750	120200	118930	119570	540	122700	95750	11,111

Est vol 38,217; vol Fri 36,338; open int 683,891, +300.

TRAKRS Long-Short Tech (CME)-$1 x index

July	36.79	37.31	36.68	36.89	.22	45.25	19.76	153,940

Est vol 276; vol Fri 0; open int 153,940, unch.

Idx pri: Hi 37.17; Lo 36.26; Close 36.70, +.39.

Russell 2000 (CME)-$500 x index

Mar	613.40	624.50	612.80	620.00	7.25	650.50	517.25	20,796

Est vol 1,848; vol Fri 1,380; open int 20,796, +89.

Idx pri: Hi 623.30; Lo 613.21; Close 617.74, +4.51.

Russell 1000 (NYBOT)-$500 x index

Mar	635.75	640.00	635.75	638.75	3.00	655.00	630.50	74,899

Est vol 274; vol Fri 216; open int 74,899, -4.

Idx pri: Hi 640.57; Lo 634.96; Close 638.09, +2.51.

NYSE Composite Index (NYBOT)-$50 x index

Mar	7080.00	7080.00	7080.00	7085.00	20.00	7252.00	6980.00	1,164

Est vol 1; vol Fri 24; open int 1,164, +4.

Idx pri: Hi 7106.97; Lo 7055.54; Close 7081.70, +24.19.

U.S. Dollar Index (NYBOT)-$1,000 x index

Mar	83.63	83.63	83.21	83.36	-.36	93.87	80.48	16,183
June	83.60	83.50	83.40	83.40	-.36	90.80	80.67	2,839

Est vol 2,061; vol Fri 7,407; open int 19,277, -1,451.

Idx pri: Hi 83.61; Lo 83.13; Close 83.29, -.31.

Nikkei Stock Average (CME)-$5 x index

Mar	11445.	11510.	11440.	11470.	35	12190.	10498.	31,110

Est vol 3,077; vol Fri 3,917; open int 31,167, -218.

Index: Closed

Share Price Index (SFE)-AUD 25 x index

Mar	4070.0	4087.0	4058.0	4078.0	6.0	4094.0	3390.0	151,246
June	4084.0	4097.0	4077.0	4092.0	7.0	4097.0	3407.0	3,421
Sept	4084.0	4102.0	4083.0	4097.0	5.0	4102.0	3398.0	3,808

Est vol 10,109; vol Fri 10,372; open int 160,405, +772.

Index: Hi na; Lo na; Close 4074.9, +11.7.

CAC-40 Stock Index (MATIF)-€10 x index

Jan	3874.0	3887.5	3851.5	3880.0	-1.5	3890.5	3727.0	375,732
Feb	3891.5	3892.5	3871.0	3886.0	-1.5	3892.5	3740.0	1,192
Mar	3891.5	3894.0	3875.5	3891.5	-1.5	3900.0	3548.5	88,044

Est vol 41,400; vol Fri 63,485; open int 480,167, +17,521.

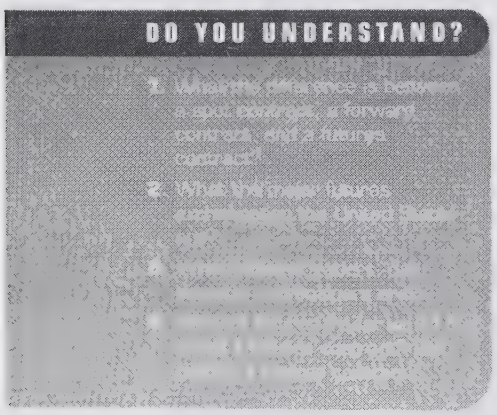
Index: Hi 3898.39; Lo 3860.15; Close 3877.82, -8.14.

high price, and low price at which trades occurred during the day (e.g., 112–09 = 112$^{9}/_{32}$% of $100,000 = $112,281.25 at the open of trading on January 10, 2005). The fifth column, labeled SETTLE, is a representative price at which a trade occurs at the end of the day.[7] If trading in a futures contract is active, the settle price is the price on the last trade of the day. If, however, the contract does not trade actively, the settlement price is determined by a committee of the exchange immediately after the market's close. The settlement price is the price used to determine the value of a trader's position at the end of each trading day. The sixth column, labeled CHG, is the change in the futures price quote from the previous day's settlement price. Columns 7 and 8, labeled LIFETIME HIGH and LOW, are the highest and lowest prices at which a trade has occurred over the life of the futures contract. Finally, the last column, labeled OPEN INT, is the **open interest,** or total number of futures contract outstanding at the beginning of the day. The bottom line of the futures quote lists the estimated trading volume for the day (e.g., 147,946 contracts), the volume of trading in the contract the previous day (e.g., 379,969), and the number of contracts outstanding for that type (T-bonds), regardless of expiration month (e.g., 631,291).

open interest
The total number of the futures, put option, or call option contracts outstanding at the beginning of the day.

A holder of a futures contract has two choices for liquidating his or her position: liquidate the position before the futures contract expires, or hold the futures contract to expiration. To liquidate before the expiration date, the futures holder simply calls his or her broker and requests an offsetting trade to his or her original position, an opposite position. For example, if the original transaction was a buy or long position, the trader can sell or short the same futures contract. Thus, any losses on the buy position will be exactly offset by gains on the sell position over the remaining life (time) to expiration of the contract. Generally, a vast majority (99 percent in the early 2000s) of all futures positions are liquidated before maturity.

If the futures holder keeps the futures contract to expiration, the parties will either (as specified in the futures contract) conduct a cash settlement where the traders exchange cash based on the final price of the underlying asset relative to the futures price, or the futures holder will take delivery of the underlying asset (e.g., a T-bond) from the futures seller.



Profit and Loss on a Futures Transaction. In Table 10–5, a March 2005 Treasury bond futures contract traded on the CBT could be bought (long) or sold (short) on January 10, 2005, for 112$^{11}/_{32}$ (or 112.34375) percent of the face value of the T-bond. The minimum contract size on one of these futures is $100,000, so a position in one contract can be taken at a price of $112,343.75.

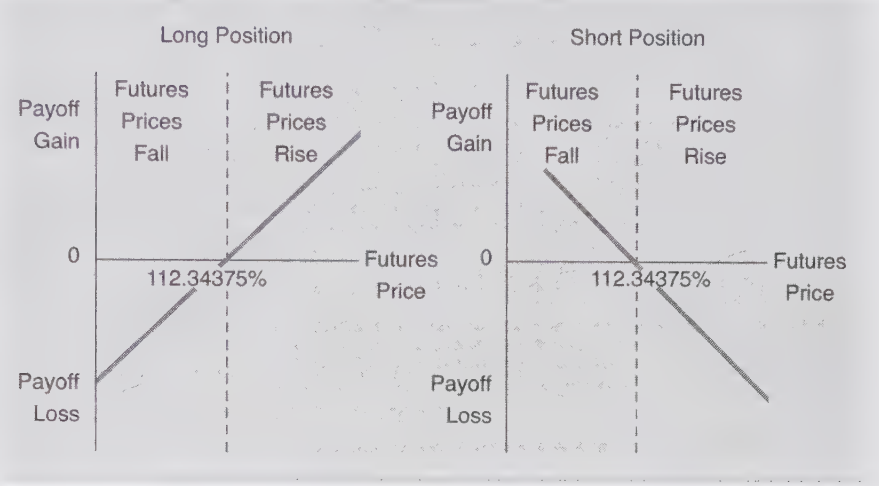
The subsequent profit or loss from a position in March 2005 T-bonds taken on January 10, 2005, is graphically described in Figure 10–2. A long position in the futures market produces a profit when the value of the underlying T-bond increases (i.e., interest rates fall between January 10, 2005, and the March expiration).[8] A short position in the futures will produce a profit when the value of the underlying T-bond decreases (i.e., interest rates rise). For example, if the T-bond futures price falls to 111–16 percent (or 111$^{16}/_{32}$% = 111.5%) of the face value between January 10, 2005, and the March expiration, the long position incurs a loss of $843.75 ((111.5% − 112.34375%) × $100,000), while the short position incurs a gain of $843.75.[9]

7. One model that explains how futures prices are determined is the cost of carry model. This model asserts that the futures price equals the spot price on the underlying asset plus the cost of carrying the asset over the life of the futures contract. Carrying costs include any financing costs of purchasing the underlying asset (e.g., interest costs) plus any storage, insurance, and transportation costs. For financial futures the costs of storage, insurance, and transportation are negligible.

8. Notice that if rates move in an opposite direction from that expected, losses are incurred on the futures position. That is, if rates rise and futures prices drop, the long investor loses on his or her futures position. Similarly, if rates fall and futures prices rise, the short investor loses on his or her futures position.

9. It should be noted that a risk in trading of derivatives is that favorable price moves may occur after the derivative contract matures. For example, if the T-bond futures price falls to 114–6 on April 1, 2005, the March T-bond contract would have matured and the long futures trader would have incurred no profit.

FIGURE 10–2 Profit or Loss on a Futures Position in Treasury Bonds Taken on January 10, 2005



4 OPTIONS

An **option** is a contract that gives the holder the right, but not the obligation, to buy or sell an underlying asset at a prespecified price for a specified time period. An **American option** gives the option holder the right to buy or sell the underlying asset at *any time* before and on the expiration date of the option. A **European option** (e.g., options on the S&P 500 Index) gives the option holder the right to buy or sell the underlying option *only* on the expiration date. Most options traded on exchanges in the United States and abroad are American options. Options are classified as either call options or put options. We discuss both of these below, highlighting their payoffs in terms of price movements on the underlying asset.

option
A contract that gives the holder the right, but not the obligation, to buy or sell the underlying asset at a specified price within a specified period of time.

American option
An option that can be exercised at any time before and on the expiration date.

European option
An option that can be exercised only on the expiration date.

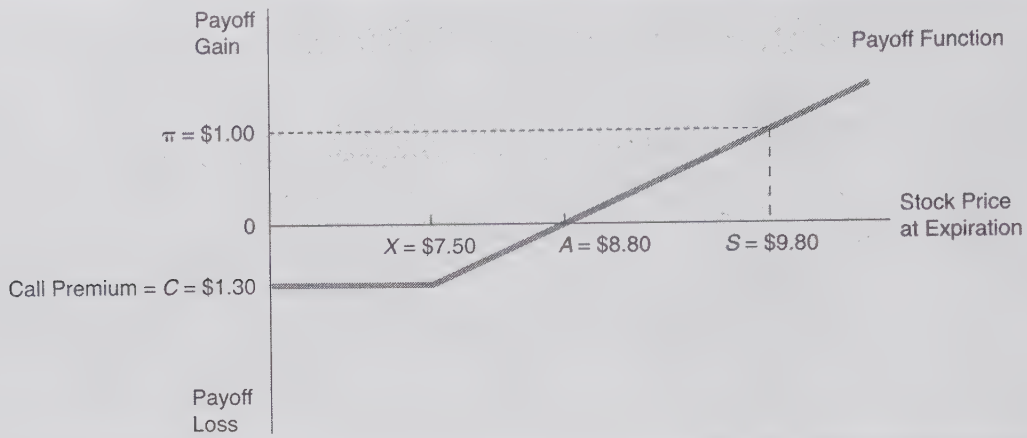
call option
An option that gives a purchaser the right, but not the obligation, to buy the underlying security from the writer of the option at a prespecified exercise price on a prespecified date.

Call Options

A **call option** gives the purchaser (or buyer) the right to buy an underlying security (e.g., a stock) at a prespecified price called the *exercise* or *strike* price (X). In return, the buyer of the call option must pay the writer (or seller) an up-front fee known as a *call premium* (C). This premium is an immediate negative cash flow for the buyer of the call option. However, he or she potentially stands to make a profit should the underlying stock's price be greater than the exercise price (by an amount exceeding the premium) when the option expires. If the price of the underlying stock is greater than X (the option is referred to as "in the money"), the buyer can exercise the option, buying the stock at X and selling it immediately in the stock market at the current market price, greater than X. If the price of the underlying stock is less than X when the option expires (the option is referred to as "out of the money"), the buyer of the call would not exercise the option (i.e., buy the stock at X when its market value is less than X). In this case, the option expires unexercised. The same is true when the underlying stock price is equal to X when the option expires (the option is referred to as "at the money"). The call buyer incurs a cost C (the call premium) for the option, and no other cash flows result.

Buying a Call Option. The profit or loss from buying a call option is illustrated in Figure 10–3. As Figure 10–3 shows, if, as the option expires, the price of the stock underlying the option is S, the buyer makes a profit of π, which is the difference between the stock's price (S, e.g., \$9.80) and the exercise price of the option (X, e.g., \$7.50) minus the

FIGURE 10–3 Payoff Function for the Buyer of a Call Option on a Stock



call premium paid to the writer of the option (C, e.g., $1.30). If the underlying stock's price is A (i.e., $8.80) as the option expires, the buyer of the call has just broken even because the net proceeds from exercising the call ($A - X = \$8.80 - \$7.50 = \$1.30$) just equals the premium payment for the call (C, or $1.30 in this case).

Notice two important things about call options in Figure 10–3:

1. As the underlying stock's price rises, the call option buyer has a large profit potential: The higher the underlying stock's price at expiration, the larger the profit on the exercise of the option, that is, if $S = \$9.80$, then $\pi = \$9.80 - \$7.50 - \$1.30 = \$1$.
2. As the underlying stock's price falls, the call option buyer has a higher potential for losses, but they are limited to the call option premium. If the underlying stock's price at expiration is below the exercise price, X, the call buyer is not obligated to exercise the option. Thus, the buyer's losses are limited to the amount of the up-front premium payment (C, or $1.30 in this case) made to purchase the call option.

Thus, buying a call option is an appropriate position when the underlying asset's price is expected to rise.[10]

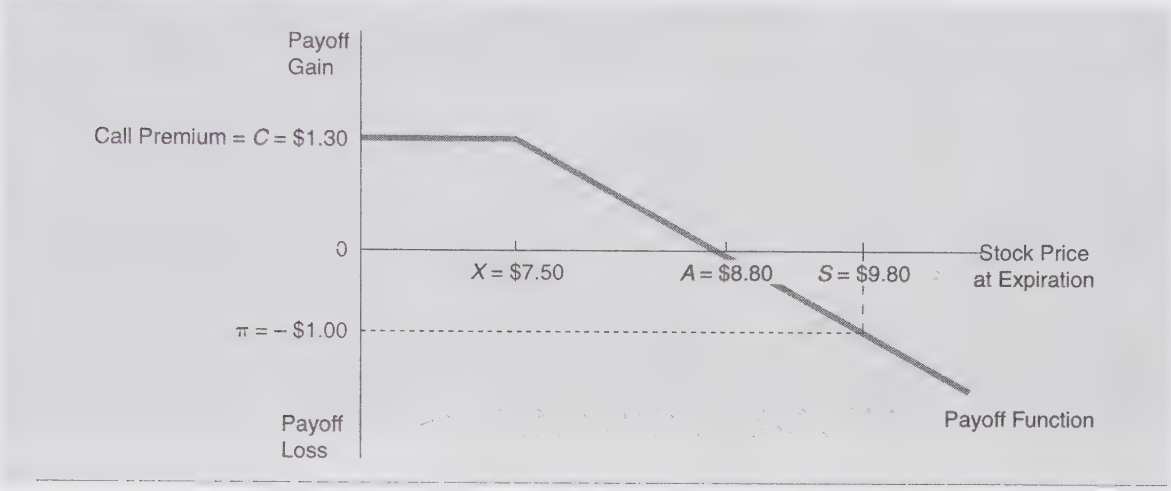
Writing a Call Option. The writer of a call option sells the option to the buyer (or is said to take a short position in the option). In writing a call option on a stock, the writer or seller receives an up-front fee or premium (C, e.g., $1.30) and must stand ready to sell the underlying stock to the purchaser of the option at the exercise price, X, (e.g., $7.50). Note the payoff from writing a call option on a stock in Figure 10–4.

Notice two important things about this payoff function:

1. As the underlying stock's price falls, the potential for a call option writer to receive a positive payoff (or profit) increases. If the underlying stock's price is less than the exercise price (X) at expiration, the call option buyer will not exercise the option. The call option writer's profit has a maximum value equal to the call premium (C, or $1.30 in this case) charged up front to the buyer of the option.

10. Traders using options get extra leverage on their investments. For example, suppose that a stock price is $32 and an investor who feels that this price will rise buys call options with an exercise price of $35 for $0.50 per option. If the price does not go above $35 during the life of the option, the investor will lose $0.50 per option (or 100 percent of the investment). However, if the price rises to $40, the investor will realize a profit of $4.50 per option (or 900 percent of the original investment).

FIGURE 10–4 Payoff Function for the Writer of a Call Option on a Stock



2. As the underlying stock's price rises, the call option writer has unlimited loss potential. If the underlying stock's price (S, e.g., $9.80) is greater than the exercise price (X, e.g., $7.50) at expiration, the call option buyer will exercise the option, forcing the option writer to buy the underlying stock at its high market price and then sell it to the call option buyer at the lower exercise price. That is, if $S = \$9.80$, then $\pi = \$1.30 - \$9.80 + \$7.50 = -\$1$. Since stock prices are theoretically unbounded in the upward direction, these losses could be very large.

Thus, writing a call option is an appropriate position when the underlying asset's price is expected to fall. Caution is warranted, however, because profits are limited but losses are potentially unlimited. A rise in the underlying stock's price to S results in the writer of the option losing π (in Figure 10–4).

Put Options

put option

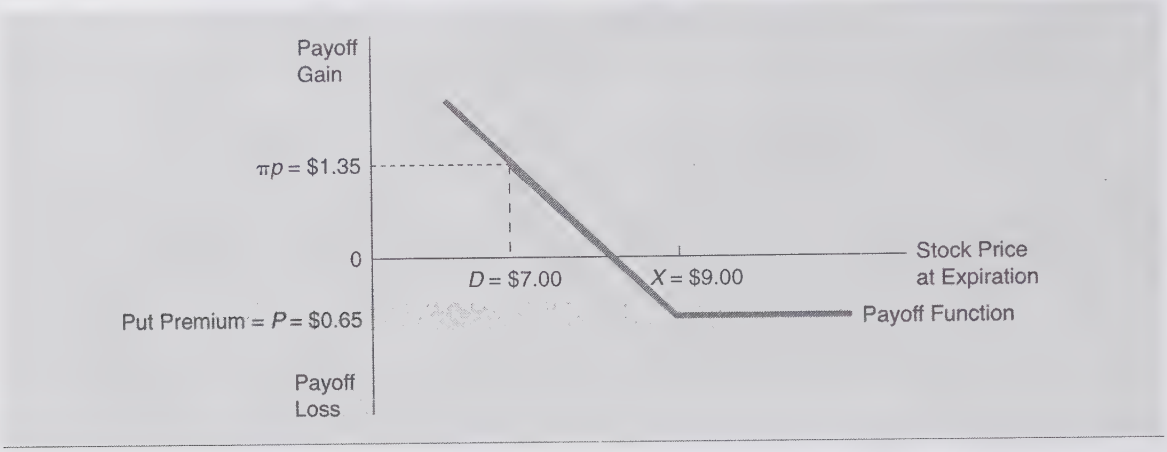
An option that gives a purchaser the right, but not the obligation, to sell the underlying security to the writer of the option at a prespecified price on a prespecified date.

A **put option** gives the option buyer the right to sell an underlying security (e.g., a stock) at a prespecified price to the writer of the put option. In return, the buyer of the put option must pay the writer (or seller) the put premium (P). If the underlying stock's price is less than the exercise price (X) when the option expires (the put option is "in the money"), the buyer will buy the underlying stock in the stock market at less than X and immediately sell it at X by exercising the put option. If the price of the underlying stock is greater than X when the option expires (the put option is "out of the money"), the buyer of the put option never exercises the option (i.e., selling the stock at X when its market value is more than X). In this case, the option expires unexercised. This is also true if the price of the underlying stock is equal to X when the option expires (the put option is trading "at the money"). The put option buyer incurs a cost P for the option, and no other cash flows result.

Buying a Put Option. The buyer of a put option on a stock has the right (but not the obligation) to sell the underlying stock to the writer of the option at an agreed exercise price (X, e.g., $9.00). In return for this option, the buyer of the put option pays a premium (P, e.g., $0.65) to the option writer. We show the potential payoffs to the buyer of the put option in Figure 10–5. Note the following:

1. The lower the price of the underlying stock at the expiration of the option, the higher the profit to the put option buyer upon exercise. For example, if stock prices fall to D (=$7.00) in Figure 10–5, the buyer of the put option can purchase the underlying stock in the stock

FIGURE 10–5 Payoff Function for the Buyer of a Put Option on a Stock



market at $D = \$7.00$ and put it (sell it) back to the writer of the put option at the higher exercise price $X = \$9.00$. As a result, after deducting the cost of the put premium, $P = \$0.65$, the buyer makes a profit of πp ($= -\$7.00 - \$0.65 + \$9.00 = \$1.35$) in Figure 10–5.

2. As the underlying stock's price rises, the probability that the buyer of a put option has a negative payoff increases. If the underlying stock's price is greater than the exercise price ($X = \$9.00$) at expiration, the put option buyer will not exercise the option. As a result, his or her maximum loss is limited to the size of the up-front put premium ($P = \$0.65$ in this case) paid to the put option writer.

Thus, buying a put option is an appropriate position when the price on the underlying asset is expected to fall.

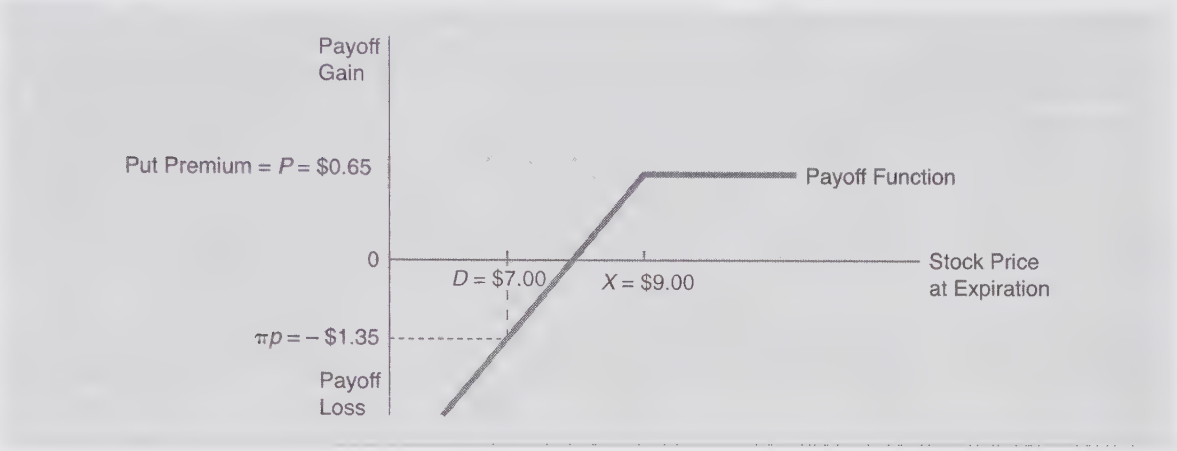
Writing a Put Option. The writer or seller of a put option receives a fee or premium (P, e.g., \$0.65) in return for standing ready to buy the underlying stock at the exercise price (X, e.g., \$9.00) should the buyer of the put choose to exercise the option at expiration. See the payoff function for writing a put option on a stock in Figure 10–6. Note the following:

1. When the underlying stock's price rises, the put option writer has an enhanced probability of making a profit. If the underlying stock's price is greater than the exercise price ($X = \$9.00$) at expiration, the put option buyer will not exercise the option. The put option writer's maximum profit, however, is constrained to equal the put premium (P, or \$0.65 in this case).
2. When the underlying stock's price falls, the writer of the put option is exposed to potentially large losses. If the price of the underlying stock is below the exercise price (e.g., $D = \$7.00$ in Figure 10–6), the put option buyer will exercise the option, forcing the option writer to buy the underlying stock from the option buyer at the exercise price ($X = \$9.00$) when it is worth only $D = \$7.00$ in the stock market (i.e., if $D = \$7.00$, then $\pi p = \$0.65 - \$9.00 + \$7.00 = -\$1.35$). The lower the stock's price at expiration relative to the exercise price, the greater the losses to the option writer.

Thus, writing a put option is an appropriate position if the price on the underlying asset is expected to rise. However, profits are limited and losses are potentially large.

Notice from the above discussion that an option holder has three ways to liquidate his or her position. First, if conditions are never profitable for an exercise (the option remains "out of the money"), the option holder can let the option expire unexercised. Second, if conditions are right for exercise (the option is "in the money"), the holder can take the opposite side of the transaction: thus, an option buyer can sell options on the underlying asset with the same exercise price and the same expiration date. Third, if conditions are right for exercise, the

FIGURE 10–6 Payoff Function for the Writer of a Put Option on a Stock



option holder can exercise the option, enforcing the terms of the option. For an American option, this exercise can theoretically occur any time before the option expires, while for a European option this exercise can occur only as the option expires, that is, on its maturity.

Option Values

The model most commonly used by practitioners and traders to price and value options is the Black–Scholes pricing model. The Black–Scholes model examines five factors that affect the price of an option:

1. The spot price of the underlying asset
2. The exercise price on the option
3. The option's exercise date
4. Price volatility of the underlying asset
5. The risk-free rate of interest

We show how to calculate an option's time value and, in turn, its overall value for any price of the underlying asset (at any point in time prior to maturity for a European option) using Black–Scholes option pricing model in the appendix to this chapter located at the book's Web site (**www.mhhe.com/sc3e**). In the body of the text we discuss these factors and the intuition behind their effect on an option's value.

Notice in the discussion above that we examined the profit and loss from exercising an option *at expiration.* The profit and loss on an option was a function of the spot price of the option's underlying asset and the exercise price on the option. The difference between the underlying asset's spot price and an option's exercise price is called the option's **intrinsic value.** For a call option, the intrinsic value is:

intrinsic value of an option

The difference between an option's exercise price and the underlying asset's price.

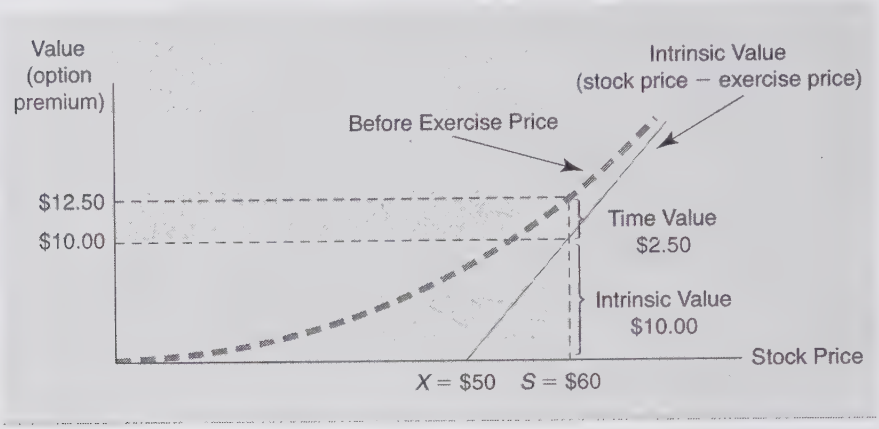
Stock price − Exercise price	if Stock price > Exercise price (option is in the money)
Zero	if Stock price ≤ Exercise price (option is out of the money)

For a put option, the intrinsic value is:

Exercise price − Stock price	if Stock price < Exercise price (option is in the money)
Zero	if Stock price ≥ Exercise price (option is out of the money)

At expiration, an option's value is equal to its intrinsic value.

FIGURE 10–7 The Intrinsic Value versus the Before-Exercise Value of a Call Option



We limit the analysis of the profit and loss on an option to exercise at expiration because research has found that it is generally not optimal to exercise an option before its expiration date because of its potential "time value" (see below).[11] Specifically, exercising a call option early (prior to expiration) is only appropriate if the value of the option before expiration is always less than its intrinsic value, which is rarely the case.

Figure 10–7 illustrates the time value effect for a call option. For example, suppose you have a call option on a stock with an exercise price of $50 and an expiration in three months. The underlying stock's price is currently $60. The intrinsic value of the option is $10 ($60 − $50). The option is currently selling on the Chicago Board of Trade for $12.50. Thus, the value of the call option is greater than its intrinsic value by $2.50. The difference between an option's price (or premium) and its intrinsic value is called its **time value.** If you exercise the option today (prior to expiration), you receive the intrinsic value but give up the time value (which in this example is $2.50).

time value of an option

The difference between an option's price (or premium) and its intrinsic value.

The time value of an option is the value associated with the probability that the intrinsic value *could* increase (if the underlying asset's price moves favorably) between the option's purchase and the option's expiration date itself. The time value of an option is a function of the price volatility of the underlying asset and the time until the option matures (its expiration date). As price volatility increases, the chance that the stock will go up or down in value increases. The owner of the call option benefits from price increases but has limited downside risk if the stock price decreases, since the loss of value of an option can never exceed the call premium. Thus, over any given period of time, the greater the price volatility of the underlying asset, the greater the chance the stock price will increase and the greater the time value of the option. Further, the greater the time to maturity, the greater (longer in time) the opportunity for the underlying stock price to increase; thus, the time value of the option increases.

It is this "time value" that allows an out of the money option to have value and trade on the option markets. As noted above, a call option is out of the money if the exercise price is greater than the underlying stock's price, or the intrinsic value of the option is zero. This option still has "time" value and will trade at a positive price or premium, however, if investors believe that prior to the option's expiration, the stock price might increase (to a value greater than the exercise price). As an option moves toward expiration, its time value goes to zero. At any point in time, the time value of an option can be calculated by subtracting its intrinsic value (e.g., $10) from its current market price or premium (e.g., $12.50).

11. See J. Cox and M. Rubinstein, *Options Markets* (Englewood Cliffs, NJ: Prentice-Hall, 1985).

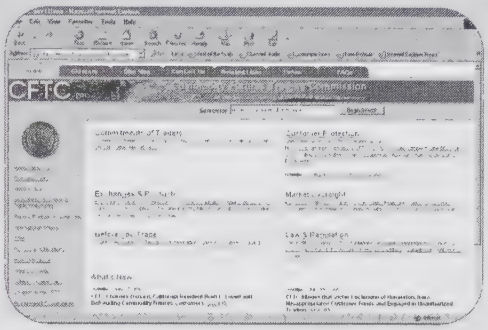
SEARCH THE SITE

Go to the Commodity Futures Trading Commission Web site at **www.cftc.gov** and find the most recent information on the futures and options volume.

Click on "Reports & Publications"

Click on "FY 200X Annual Report to Congress" under "Commission Reports"

This will download a file on to your computer that will contain data on futures contracts outstanding, traded, and maturing. The data are in the Appendices to the Annual Report.



Questions

1. Calculate the percentage change in average month end futures contracts outstanding, number of futures contracts outstanding, and number of futures contracts maturing since 2003 reported in Table 10–3.
2. Calculate the percentage change in average month end option contracts outstanding and number of option contracts traded since 2003 reported in Table 10–6.

The risk-free rate of interest affects the value of an option in a less than clear-cut way. All else constant, as the risk-free rate increases, the growth rate of the stock price increases. Recall from Chapter 3 that as the risk-free rate of interest increases, the required rate (and ultimately realized rate) of return increases on all investments. The result is greater stock price growth. However, the present value of any future cash flows received by the option holder decreases. For a call option, the first effect tends to increase the price of the option, while the second effect tends to decrease the price. It can be shown that the first effect always dominates the second effect. That is, the price of a call option always increases as the risk-free rate increases. Conversely, the two effects both tend to decrease the value of a put option. Thus, the price of a put option decreases as the risk-free rate increases.

Option Markets

www.cboe.com

The Chicago Board of Options Exchange (CBOE) opened in 1973. It was the first exchange devoted solely to the trading of stock options. In 1982, financial futures options contracts (options on financial futures contracts, e.g., Treasury bond futures contracts) started trading. Options markets have grown rapidly since the mid-1980s.

Table 10–6 shows the level of trading activity in the options markets from 1992 through 2003. Table 10–7 lists the characteristics of some of the most active option contracts. The largest option exchange is the Chicago Board Options Exchange (CBOE).[12]

www.liffe.com

The first option exchanges abroad were the European Options Exchange and the London International Financial Futures Exchange (LIFFE). Options exchanges have more recently been opened in Paris, Sweden, Switzerland, Germany, and Japan. As with futures trading, many options also trade over the counter. Thus, the volume of trading in options is more than what is reported in the option quotes (see below) for the organized exchanges.

12. Other major exchanges are the American Stock Exchange, CBT, CME, IMM, Pacific Stock Exchange, Philadelphia Exchange, New York Stock Exchange, and the Financial Instrument Exchange of the New York Cotton Exchange.

TABLE 10–6 Options Market Activity, 1992–2003

	1992	1995	2000	2003
Average month-end contracts outstanding (in thousands)	1,585.8	3,285.4	4,007.5	12,857.4
Number of contracts traded (in thousands)	39,928.1	65,502.6	64,695.8	173,915.2

Source: Commodity Futures Trading Commission Web site, January 2000 and 2005. **www.cftc.gov**

The trading process for options is similar to that for futures contracts. An investor desiring to take an option position calls his or her broker and places an order to buy or sell a stated number of call or put option contracts with a stated expiration date and exercise price. The broker directs this order to its representative on the appropriate exchange for execution. Most trading on the largest exchanges such as the CBOE takes place in trading pits, where traders for each delivery date on an option contract informally group together. Like futures contracts, options trading generally occurs using an open-outcry auction method.

Only option exchange members are allowed to transact on the floor of option exchanges. Trades from the public are placed with a floor broker, professional trader, or a market maker for the particular option being traded. Option trades may be placed as market orders (instructing the floor broker to transact at the best price available) or limit orders (instructing the floor broker to transact at a specified price).

Once an option price is agreed upon in a trading pit, the two parties electronically send the details of the trade to the option clearinghouse (the Options Clearing Corporation), which breaks up trades into buy and sell transactions and takes the opposite side of each transaction—becoming the seller for every option contract buyer and the buyer for every option contract seller. The broker on the floor of the options exchange confirms the transaction with the investor's broker.

In the early 2000s, the CBOE increased the speed at which orders can be placed, executed, and filled by equipping floor brokers with hand-held touch-screen computers that allow them to route and execute orders more easily and efficiently. For example, when a broker selects an order from the workstation, an electronic trading card appears on the hand-held computer screen. The electronic card allows the broker to work the order and enter necessary trade information (e.g., volume, price, opposing market makers). When the card (details of the transaction) is complete, the broker can execute the trade with the touch of a finger. Once the broker has submitted the trade, the system simultaneously sends a "fill" report to the customer and instantaneously transmits this data to traders worldwide.

Table 10–8 shows portions of an option quote table from *The Wall Street Journal* for January 10, 2005. (*The Wall Street Journal* no longer lists individual stock option quotes. The stock option quote listed in Table 10–8 is taken from *The Wall Street Journal Online*.) Three types of options trade: stock options, stock index options, and options on futures contracts. More "exotic" or special types of options (e.g., credit options—see Chapter 23) tend to trade over the counter rather than on organized exchanges. We discuss the three major types of exchange-traded options next.

Stock Options. The underlying asset on a stock option contract is the stock of a publicly traded company. One option generally involves 100 shares of the underlying company's stock. As mentioned earlier, options on U.S. option exchanges are American options. Look at the options quotes for American Airlines (AMR) in Table 10–8. The first line lists the name of the company and its closing stock price for the day (e.g., $8.79). The first column is the expiration month on the option (e.g., Jan = January 2005). The second column lists the strike or exercise price on the different options on American Airlines stock (e.g., $6 and $7.50). Note that the same stock can have many different call and put options differentiated by expiration and strike price. Further, the quote gives

TABLE 10–7 Characteristics of Actively Traded Options

Type of Option	Exchange*	Contract Traded
Stock options	CBOE	Stock options
	AM	Stockoptions
	PB	Stock options
	PC	Stock options
	NY	Stock options
Stock index options	CBOE	Dow Jones Industrial Average
	CBOE	Dow Jones Transportation Average
	CBOE	Dow Jones Utility Average
	CBOE	Nasdaq 100
	CBOE	Russell 2000
	CBOE	S&P 100 Index
	CBOE	S&P 500 Index
	AM	Euro Top 100
	AM	Hong Kong Index
	AM	Major Market Index
	AM	S&P Midcap
	PB	Gold/Silver
	PB	Oil Service
	PB	PHLX KBW Bank
	PB	Utility Index
Financial futures options:		
Interest rate	CBT	T-bonds
	CBT	T-notes
	CBT	T-notes—5 year
	CME	Eurodollar
	CME	Mid-Curve Eurodollar—1 year
	LIFFE	Eurolibor
	EUREX	Euro Bond
Currency	CME	Japanese yen
	CME	Canadian dollar
	CME	British pound
	CME	Swiss franc
	CME	Euro FX
Stock index	CBT	DJIA
	CME	S&P 500 Index

*CBOE = Chicago Board of Option Exchange, AM = American Exchange, PB = Philadelphia Stock Exchange, PC = Pacific Stock Exchange, NY = New York Stock Exchange, CBT = Chicago Board of Trade, CME = Chicago Mercantile Exchange, LIFFE = London International Financial Futures Exchange, and EUREX = The European Derivatives Market.

Source: *The Wall Street Journal*, January 11, 2005, p. C11. Reprinted by permission of *The Wall Street Journal*. © 2005, Dow Jones & Company, Inc. All Rights Reserved Worldwide. **www.wsj.com**

an indication of whether the call and put options are trading in, out of, or at the money. For example, as shown in Figure 10–8, the American Airlines call option with an exercise price of $7.50 is trading in the money ($7.50 is less than the current stock price, $8.79), while the call options with an exercise price of $10 are trading out of the money ($10 is greater than the current stock price, $8.79). The exact opposite holds for the put options. That is, the put option with an exercise price of $7.50 is trading out of the money ($7.50 is less than the current stock price, $8.79), while the put options with an exercise price of $10 are trading in the

TABLE 10–8 Option Quote, January 10, 2005

STOCK OPTIONS

Prices at close January 10, 2005

A M R (AMR)

Underlying stock price*: 8.79

		Call			Put		
Expiration	Strike	Last	Volume	Open Interest	Last	Volume	Open Interest
May	5.00	3.70	12	478	0.45	20	4175
Jun	7.50	1.35	60	1,062	0.15	178	58,904
Oct	8.00	1.35	1	2018			2490
May	8.00	1.81	20	257			1994
Aug	8.00			458	1.45	10	399
Jan	9.00	0.35	150	50,568	0.65	25	68,894
Feb	9.00	0.75	224	2721	1.00	500	3214
May	9.00	1.30	5	635			2969
Aug	9.00	1.75	10	118			32
Jan	10.00	0.10	65	55491	1.30	490	64476
Feb	10.00	0.30	595	4277	1.60	8	6452
May	10.00	0.85	60	2924			33385
Aug	10.00	1.35	21	459			243
Jan	11.00	0.15	375	4123	2.30	15	5367
Feb	12.00	0.10	200	5099			1647
Jan	12.50			10220	3.80	20	15853
Feb	13.00	0.05	3000	5907			131
May	13.00	0.75	63	592			50
Aug	13.00	0.50	100	923			14
Aug	20.00	0.05	12	116			3

*Underlying stock price represents listed exchange price only (it may not match the composite closing price.

FUTURES OPTIONS

STRIKE	CALLS–SETTLE			PUTS–SETTLE		
Interest Rate						
T-Bonds (CBT)						
$100,000; points and 64ths of 100%						
Price	Feb	Mar	Apr	Feb	Mar	Apr
110	2-27	2-52	...	0-05	0-20	1-09
111	1-34	2-05	2-42	0-14	0-47	1-37
112	0-54	1-24	1-53	0-32	1-07	2-01
113	0-32	0-51	1-06	1-00	1-39	...
114	0-17	0-37	0-58	1-49	2-15	...
115	0-11	0-22	0-38	2-44	2-58	...
Est vol 40,597;						
Fri vol 22,793 calls 37,460 puts						
Op int Fri 242,359 calls 343,665 puts						
T-Notes (CBT)						
$100,000; points and 64ths of 100%						
Price	Feb	Mar	Apr	Feb	Mar	Apr
109	...	2-33	...	0-01	0-08	0-34
110	1-06	1-41	1-28	0-08	0-18	0-56
111	0-33	0-57	0-53	0-24	0-38	1-21
112	0-18	0-31	0-29	0-47	1-05	...
113	0-07	0-12	0-15	1-39	1-48	...
114	0-01	0-06	0-07	...	2-43	...
Est vol 192,881 Fr 122,929 calls 152,054 puts						
Op int Fri 907,826 calls 1,235,599 puts						
5 Yr Treas Notes (CBT)						
$100,000; points and 64ths of 100%						
Price	Feb	Mar	Apr	Feb	Mar	Apr
10840	0-53	...	...	0-02	0-13	0-33
10850	0-35	0-50	0-45	0-06	0-22	0-46
10900	0-15	0-22	0-20	0-18	0-38	...
10950	0-04	0-07	0-09	0-39	0-52	1-20
11000	0-01	0-03	...	1-04	1-12	...
11050	0-01	0-01	...	1-35	1-39	...
Est vol 77,636 Fr 17,615 calls 57,440 puts						
Op int Fri 174,427 calls 497,173 puts						
Eurodollar (CME)						
$ million; pts. of 100%						
Price	Jun	Feb	Mar	Jun	Feb	Mar
9695	...	...	.290	.080	.000	.000
9700	.040	.052	.065	.000	.017	.025
9725	.009	.005	.018	.210	.215	.220
9750	.020	.008	.010	.480	...	.460
9775	.000	...	.008	...	...	.710
9800	.000	...	.000	.960	...	.960
Est vol 829,567;						
Fr vol 207,891 calls 664,290 puts						
Op int Fri 5,123,522 calls 5,237,907 puts						
Index						
Mini DJ Industrial Avg (CBT)						
$5 times premium						
Price	Jan	Feb	Mar	Jan	Feb	Mar
104	2.48	3.07	3.43	0.20	0.81	1.35
105	1.65	2.38	2.94	0.37	1.10	1.66
106	0.98	1.75	2.34	0.78	1.47	2.06
107	0.50	1.24	1.86	1.22	1.96	2.52
108	0.22	0.82	1.35	1.94	2.54	3.07
109	0.09	0.51	0.98	2.81	3.23	3.70
Est vol 1,474 Fr 903 calls 1,229 puts						
Op int Fri 10,976 calls 11,174 puts						
S&P 500 Stock Index (CME)						
$250 times premium						
Price	Jan	Feb	Mar	Jan	Feb	Mar
1180	17.20	25.50	32.20	5.50	13.80	20.40
1185	13.80	22.40	29.20	7.10	15.70	22.50
1190	10.70	19.60	26.30	9.00	17.90	24.40
1195	8.10	17.00	23.50	11.40	20.30	26.80
1200	6.20	14.60	21.00	14.70	22.90	29.20
1205	4.20	12.30	18.50	17.50	25.60	31.70
Est vol 29,977 Fr 7,747 calls 12,644 puts						
Op int Fri 145,329 calls 295,519 puts						

STRIKE	CALLS–SETTLE			PUTS–SETTLE		
Currency						
Japanese Yen (CME)						
12,500,000 yen; cents per 100 yen						
Price	Feb	Mar	Jun	Feb	Mar	Jun
9550	1.51	1.80	...	0.66	0.98	...
9600	1.22	1.61	2.76	0.81	1.20	1.68
9650	0.97	1.37	2.52	1.06	1.46	1.92
9700	0.76	1.16	2.29	1.35	1.75	2.18
9750	0.59	0.98	...	1.68	2.07	...
9800	0.45	0.83	1.87	...	2.41	2.75
Est vol 486 Fr 1,427 calls 1,346 puts						
Op int Fri 36,020 calls 21,218 puts						
Canadian Dollar (CME)						
100,000 Can.$; cents per Can.$						
Price	Feb	Mar	Jun	Feb	Mar	Jun
8100	1.35	1.68	2.41	0.91	0.84	1.52
8150	1.08	1.38	2.05	0.70	1.04	...
8200	0.78	1.12	1.87	0.94	1.29	1.97
8250	0.58	0.91	...	1.24	1.57	2.00
8300	0.42	0.74	1.45	1.58	1.90	2.54
8350	0.30	0.59	1.28	...	2.30	...
Est vol 2,472 Fr 568 calls 988 puts						
Op int Fri 11,113 calls 9,653 puts						
British Pound (CME)						
62,500 pounds; cents per pound						
Price	Feb	Mar	Jun	Feb	Mar	Jun
1850	...	2.52	...	0.97	1.48	2.61
1860	...	2.96	4.30	1.34	2.07	4.06
1870	1.72	2.48	3.62	1.83	2.51	4.57
1880	1.38	1.95	...	2.41	3.06	0.00
1890	0.96	1.56	2.79	3.07	3.66	5.72
1900	0.76	1.23	2.43	3.80	4.33	6.35
Est vol 260 Fr 236 calls 1,380 puts						
Op int Fri 3,596 calls 3,463 puts						
Swiss Franc (CME)						
125,000 francs; cents per franc						
Price	Feb	Mar	Jun	Feb	Mar	Jun
8400	...	1.91	...	...	1.06	1.79
8450	...	...	...	0.83	...	...
8500	0.92	1.38	...	1.20	1.53	...
8550	...	...	...	1.74	1.81	2.68
8600	0.54	0.97	2.01	1.69	2.12	2.71
8650	0.40	...	...	2.05	2.43	...
Est vol 37 Fr 151 calls 766 puts						
Op int Fri 1,317 calls 3,199 puts						
Euro Fx (CME)						
125,000 euros; cents per euro						
Price	Feb	Mar	Jun	Feb	Mar	Jun
13000	1.28	2.59	3.87	0.98	1.52	2.66
13050	...	2.23	...	1.12	1.75	2.89
13100	1.36	1.98	3.37	1.38	2.00	3.16
13150	1.13	1.74	3.13	1.65	2.28	3.41
13200	0.92	1.52	2.91	1.94	2.55	3.68
13250	0.75	1.33	2.69	2.27	2.84	3.96
Est vol 2,814 Fr 11,706 calls 18,371 puts						
Op int Fri 64,979 calls 54,080 puts						

STOCK INDEX OPTIONS

STRIKE	VOL	LAST	NET CHG	OPEN INT
DJ INDUS AVG(DJX)				
Mar 88p	16	0.10	...	5,192
Mar 92p	20	0.35	...	3,133
Mar 94p	20	0.70	...	2,029
Mar 98p	3	0.40	...	7,871
Jan 100 c	21	6.40	-0.20	10,381
Mar 103 c	2	7.20	-1.20	8,541
Mar 106p	199	0.60	-0.10	12,510
Jan 101 c	75	5.60	...	3,438
Feb 101 p	14	0.30	-0.10	2,065
Jan 102 c	18	4.10	-1.50	2,208
Feb 102 c	2	4.20	-0.80	11
Jan 103 c	102	3.20	...	8,432
Jan 103 p	488	0.10	-0.10	3,417
Feb 103 p	1,018	0.50	-0.25	678
Mar 103 p	65	1.05	0.20	1,552
Jan 104 c	55	2.40	-0.30	2,649
Jan 104 p	561	0.20	0.05	4,667
Feb 104 p	88	0.65	-0.20	1,315
Mar 104 c	3	3.70	...	4,230
Mar 104 p	1,006	1.35	-0.20	4,455
Jan 105 c	24	1.75	...	35,601
Jan 105 p	389	0.35	-0.25	30,529
Feb 105 c	41	2.30	-0.05	1,769
Feb 105 p	515	1.10	-0.15	574
Mar 105 p	4	1.70	-0.25	870
Jan 106 c	352	0.80	-0.20	18,689
Jan 106 p	311	0.80	0.05	6,954
Feb 106 c	476	1.80	0.10	2,987
Feb 106 p	869	1.65	0.20	1,342
Mar 106 c	275	2.35	0.10	14,459
Mar 106 p	227	2.15	-0.10	8,277
Jan 107 c	303	0.35	-0.15	15,040
Jan 107 p	260	1.30	-0.20	6,677
Feb 107 c	548	1.25	-0.25	1,256
Feb 107 p	13	2.10	0.20	524
Jan 108 c	1,354	0.20	...	10,981
Jan 108 p	13	2	0.20	6,564
Feb 108 c	1,305	0.85	0.05	5,629
Feb 108 p	50	2.35	-0.65	1,740
Mar 108 c	253	1.35	-0.15	6,731
Mar 108 p	79	2.90	-0.30	784
Jan 109 c	46	0.10	-0.05	2,519
Jan 109 p	18	2.55	-0.45	3,342
Feb 109 c	18	0.50	...	7,964
Mar 109 c	105	0.95	-0.50	196
Jan 110 c	15	0.05	...	5,644
Jan 110 p	1	8	0.10	4,432
Feb 110 c	600	0.30	-0.05	4,772
Mar 110 c	40	0.75	-0.15	5,386
Mar 110 p	30	4.20	0.40	92
Mar 112 c	20	0.35	...	6,043
Call Vol..... 7,563 Open Int...309,681				
Put Vol..... 9,043 Open Int...288,605				

STRIKE	VOL	LAST	NET CHG	OPEN INT
S & P 500(SPX)				
Jan 975 p	100	0.05	-0.05	7,996
Feb 1005 p	370	0.40	-0.20	11,777
Jan 1025 p	9,895	0.10	-0.05	20,978
Mar 1025 c	40	169.20	0.80	629
Mar 1025 p	9,352	1.65	...	74,228
Jan 1050 c	10	145.20	9.70	237
Feb 1050 c	54	140	1.90	308
Feb 1050 p	1,410	0.75	-0.05	13,329
Mar 1050 p	1	2.25	-6.25	26,793
Jan 1075 p	73	0.35	-0.05	37,065
Feb 1075 c	3	116	-0.40	97
Feb 1075 p	266	1.25	-0.35	16,187
Mar 1075 p	177	3.20	-0.80	34,926
Jan 1100 c	9	89	2.00	7,444
Jan 1100 p	1,438	0.25	-0.05	28,311
Feb 1100 p	1,340	1.70	-0.80	18,443
Mar 1100 c	40	99	7.00	10,893
Mar 1100 p	855	5	-1.00	63,982
Jan 1110 p	10	0.25	-0.20	56,881
Jan 1115 p	500	0.25	-0.15	14,581
Jan 1120 p	518	0.30	-0.30	3,134
Jan 1125 c	5	68.50	1.60	10,869
Jan 1125 p	1,435	0.45	-0.25	33,730
Feb 1125 c	50	70.30	3.70	2,055
Feb 1125 p	151	3.30	-0.70	17,239
Mar 1125 p	966	7.50	-1.50	46,629
Jan 1130 c	2	56.20	1.20	67
Jan 1130 p	100	0.60	-0.25	9,150
Feb 1130 p	153	4.10	-0.50	662
Jan 1135 c	20	60.90	2.30	2,385
Jan 1135 p	27	0.45	-0.55	5,386
Jan 1140 c	10	55.70	5.20	1,638
Jan 1140 p	179	0.60	-0.60	8,614
Feb 1140 p	69	4.80	-1.60	742
Jan 1145 p	54	1	-0.35	14,030
Jan 1150 c	160	41.20	2.20	7,398
Jan 1150 p	2,047	1.10	-0.90	43,306
Feb 1150 p	859	6.40	-1.70	11,132
Mar 1150 c	1	59.40	-2.30	13,597
Mar 1150 p	4,976	12.50	-1.50	36,357
Jan 1155 p	262	1.40	-0.60	2,388
Jan 1160 c	7	31.50	0.80	1,629
Jan 1160 p	674	1.80	-1.20	12,377
Jan 1165 c	10	27.10	1.90	67
Jan 1165 p	264	2.80	-0.80	6,837
Jan 1170 p	243	3.50	-1.50	17,342
Mar 1170 p	43	18	-1.30	1,705
Jan 1175 c	239	20	2.30	23,086
Jan 1175 p	1,339	4.40	-2.40	36,948
Feb 1175 c	279	27.70	-1.00	7,499
Feb 1175 p	167	12.10	-2.40	15,316
Mar 1175 c	380	35.20	2.70	27,927
Mar 1175 p	680	18	-1.00	27,692

STRIKE	VOL	LAST	NET CHG	OPEN INT
Jan 1180 c	277	17.50	3.50	1,700
Jan 1180 p	633	5.50	-2.80	17,112
Mar 1180 c	418	32	0.90	3,187
Mar 1180 p	40	18.90	-4.60	2,418
Jan 1185 c	425	11.90	0.90	3,019
Jan 1185 p	948	8	-2.50	10,074
Feb 1185 c	16	20	...	3,761
Feb 1185 p	899	16	-2.00	5,573
Jan 1190 c	532	19	1.50	4,767
Jan 1190 p	1,071	9.10	-3.90	11,299
Jan 1195 c	214	7	0.50	3,120
Jan 1195 p	470	13	-2.50	6,466
Jan 1200 c	7,216	5.50	0.70	53,033
Jan 1200 p	1,025	16	-3.00	44,381
Feb 1200 c	2,547	13.50	1.00	19,260
Feb 1200 p	79	22	-4.00	12,697
Mar 1200 c	2,964	21.30	1.30	51,436
Mar 1200 p	2,339	29	-3.50	39,521
Jan 1205 c	283	3.40	-0.60	2,971
Jan 1205 p	20	16	-7.00	5,120
Mar 1205 p	20	32.70	-0.30	2,948
Jan 1210 c	559	2.50	0.25	12,691
Jan 1210 p	146	19.90	-4.90	5,281
Mar 1210 c	40	18	1.60	16,147
Jan 1215 c	324	1.70	-0.05	12,441
Mar 1215 c	2	15	0.30	1,740
Jan 1220 c	1,341	1	-0.25	7,668
Jan 1220 p	153	33	1.00	2,625
Jan 1225 c	3,501	0.75	0.05	23,879
Jan 1225 p	42	36.60	-0.30	2,950
Feb 1225 c	285	5.20	-0.50	12,342
Feb 1225 p	27	39	-5.50	2,284
Mar 1225 c	772	10.80	-0.20	32,571
Mar 1225 p	31	41	-5.30	4,242
Jan 1230 c	2,319	0.45	-0.35	9,548
Jan 1235 c	356	0.35	-0.35	10,903
Jan 1235 p	30	45.70	-2.80	513
Jan 1245 c	110	0.30	-0.10	2,794
Feb 1245 c	1	2.50	0.05	2,370
Jan 1250 c	255	0.20	...	23,077
Jan 1250 p	5	50.70	0.30	2,900
Feb 1250 c	126	2	0.10	12,352
Feb 1250 p	5	64.70	-0.50	1,432
Mar 1250 c	213	4.90	0.20	25,784
Feb 1255 c	22	1.40	0.25	1,055
Jan 1275 p	150	85.20	4.70	876
Feb 1275 c	86	0.55	-0.35	5,725
Feb 1275 p	5	88.20	4.20	284
Mar 1275 c	21	2	...	12,132
Jan 1300 c	152	0.05	...	34,044
Jan 1300 p	54	107.80	12.80	273
Mar 1300 c	312	0.70	-0.30	23,687
Mar 1300 p	50	106.90	22.40	2,658
Mar 1350 c	2	6.35	0.20	2,514
Call Vol..... 53,446 Open Int...1,287,912				
Put Vol..... 84,482 Open Int...2,649,247				

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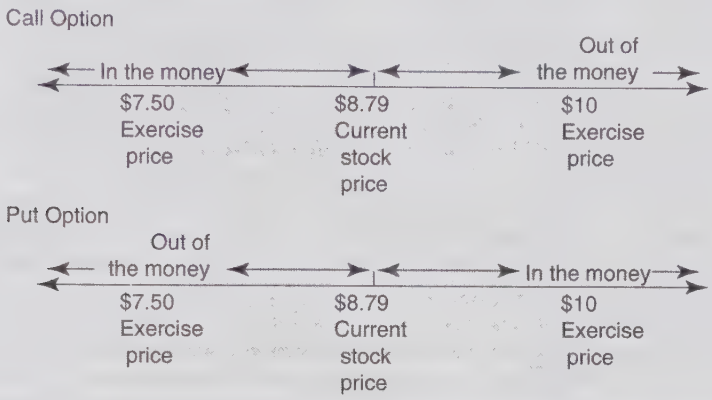
money ($10 is greater than the current stock price, $8.79). Columns 3 through 5 give data on the call options: call price or premium (e.g., LAST) of the option (e.g., $3.30, or one May call option with an exercise price of $6 would cost $3.30 × 100 = $330),[13] volume (e.g., 12 call options traded on January 10, 2005), and open interest (e.g., 578 May call options with

13. Times 100 since each option contract is for 100 shares.

FIGURE 10–8 In the Money and Out of the Money Options



a $6 strike price were outstanding at the open of trading on January 10, 2005). Columns 6 through 8 list the same type of data for put options traded.

Stock Index Options. The underlying asset on a stock index option is the value of a major stock market index (e.g., the DJIA or the S&P 500 Index—see Chapter 9). An investor would buy a call (put) option on a stock index when he or she thinks the value of the underlying stock market index will rise (fall) by the expiration date of the option. If the index does indeed rise above (fall below) the exercise price on the option, the call (put) option holder can profit by an amount equal to the intrinsic value when the option expires. A difference between a stock option and a stock index option is that at expiration, the stock index option holder cannot settle the option contract with the actual purchase or sale of the underlying stock index. Rather, at expiration, stock index options are settled in cash (i.e., the option holder receives the intrinsic value if the option is in the money and nothing if the option is out of the money). Except for the S&P 500 (which is a European option), stock index options are American options.

Options on stock indexes allow investors to invest indirectly in a diversified portfolio that replicates a major market index (e.g., the S&P 500 Index). If an investor thinks the S&P 500 Index will rise in the future, he or she can buy a call option on the S&P 500 Index. If the S&P 500 Index does rise, the value of the call option also rises. Thus, the investor can earn returns based directly on the S&P 500 Index without investing the large amounts of money needed to directly buy every stock in the index.

The dollar value associated with each stock index option is established by a particular multiplier—the value of a stock index option is equal to the index times its multiplier. For example, the multiplier on the S&P 500 index option is 500, on the S&P 100 index option is 100, on the DJIA option is 100, and on the NYSE Composite index option is 500. Thus, if an S&P 500 index option has an exercise price of 1,050, the dollar amount involved with the exercise of this option is $1{,}050 \times \$500 = \$525{,}000$.

Options on stock indexes also give investors a way to hedge their existing stock portfolios.

EXAMPLE 10–2 Using a Stock Index Option to Hedge a Stock Portfolio

Suppose that over the last seven years an investor's stock portfolio increased in value from $250,000 to $2.15 million. The stock portfolio was originally set up to (virtually) replicate the S&P 500 Index. The investor believes that due to expected rising interest rates in the next three months, stock market indexes (including the S&P 500 Index, currently at 1,075.0) will

soon experience sharp declines in value and his stock portfolio will experience the same percentage drop in value. The investor has thought of liquidating his stock portfolio but is in the 20 percent capital gains tax bracket and does not want to incur such high tax payments.

Instead, the investor takes a long position in (or buys) put options on the S&P 500 Index with a three-month expiration and an exercise price of 1,075. Incorporating the S&P 500 multiplier of $500, this is equivalent to a cost of $537,500 (1,075 × $500) per option. To hedge his $2.15 million stock portfolio, the investor would buy 4 ($2.15 million ÷ (1,075 × $500)) put options on the S&P 500 index.

Suppose the investor was correct in his expectations. In three months' time (as the put option on the S&P 500 Index expires), the S&P 500 Index has dropped 15 percent to 913.75, as has the value of his stock portfolio (now valued at $1,827,500 million). The investor has lost $322,500 in value on his stock portfolio. However, the investor can settle the put options he purchased for cash—the intrinsic value at the option's expiration is $322,500 ((1,075 − 913.75 per option) × $500 × 4 options).

The investor was able to take a position in the stock index option market such that any losses on his stock portfolio were offset with gains on the put option position in stock index options. We ignored transaction costs in this example (i.e., the premiums required to purchase the four put options), but they would be small relative to the losses the investor would have incurred had he not hedged his stock portfolio with stock index options.

Stock index option quotes (in Table 10–8) list the underlying index (e.g., DJ INDUS AVG = DJIA). The first column lists the expiration month of the option contract and the second column lists the exercise price, often listed in some submultiple of the actual value of the index (e.g., 100 = 10,000 for the DJIA), including a designation for put, p, or call, c, options traded. Column 3 is the trading volume (e.g., 21 = 21 options traded). Column 4 lists the settlement price (or premium) on the option (e.g., 6.4 means the price of one January 2005 call option with an exercise price of 100 is $6.4 × 100 = $640), and Column 5 is the change in this settlement price (or premium) from the previous day (e.g., −0.20). Finally, the last column of the quote table reports the number of contracts outstanding at the beginning of the day (e.g., 10,381).

Options on Futures Contracts. The underlying asset on a futures option is a futures contract (e.g., $100,000 Treasury bond futures—discussed above). The buyer of a call (put) option on a futures contract has the right to buy (sell) the underlying futures contract before expiration (i.e., an American option). The seller of a call (put) option on a futures contract creates the obligation to sell (buy) the underlying futures contract on exercise by the option buyer. If exercised, a call (put) option holder can buy (sell) the underlying futures contracts at the exercise price. Options on futures can be more attractive to investors than options on an underlying asset when it is cheaper or more convenient to deliver futures contracts on the asset rather then the actual asset. For example, trading options on T-bond futures contracts rather than options on T-bonds ensures that a highly liquid asset will be delivered and that problems associated with accrued interest and the determination of which long-term bond to deliver are avoided. Another advantage is that price information about futures contracts (the underlying asset on the option) is generally more readily available than price information on the T-bonds themselves (T-bond price information can be obtained only by surveying bond dealers). Options are currently written on interest rate, currency, and stock index futures contracts.

Look at the first futures option quote listed in Table 10–8 (for T-bonds). The bold heading for each quote lists the type of option (e.g., on T-bond futures contracts), face value of each option contract (e.g., $100,000), and the basis for the quote (e.g., "points and 64ths of 100%" means $2-27 = 2\ ^{27}/_{64}\%$). Each row in the quote then lists trading results for a specific exercise price (e.g., 110, 111). Column 1 lists the strike price (e.g., 110 = 110%); Columns 2 through 4 list settlement prices on call options traded,

by expiration month of the option contract (e.g., February, March, and April). The last three columns list settlement prices for the various expiration put options.[14]

DO YOU UNDERSTAND?

6 REGULATION OF FUTURES AND OPTIONS MARKETS

The Commodity Futures Trading Commission (CFTC), formed in 1974, is the primary regulator of futures markets. The CFTC's major mission is to protect the trading public by seeking to prevent misrepresentations and/or market manipulation by exchange participants. The CFTC approves new or proposed contracts to ensure they have an economic purpose, conducts economic studies of the markets, enforces the rules set by the individual exchanges, and provides regulatory surveillance of futures market participants. The CFTC also monitors futures trading in an attempt to identify market manipulation. One way the CFTC monitors trading is by obtaining information on positions of all large market participants in an attempt to identify unusual activity. The CFTC also puts limits on the number of futures contracts any trader can hold and monitors the time stamping of trades, where traders must record the time at which a trade occurs to identify irregularities.

www.cftc.gov

www.sec.gov

The Securities and Exchange Commission (SEC) is the main regulator of stock options in which delivery is based on a stock or stock index (e.g., stock options and stock index options). The CFTC is the main regulator of options on futures contracts in which delivery involves a futures contract. For example, the SEC regulates trading of S&P 500 futures options traded on the CBT, the value of which is determined by the value of the S&P 500 Index, but the CFTC regulates trading of S&P 500 futures options traded on the CME, the value of which is determined by the futures contract on the S&P 500 Index. This distinction has often caused confusion for both regulators and traders alike.

DO YOU UNDERSTAND?

The individual futures and option exchanges also set and enforce many rules on their members designed to ensure the smooth operations and financial solvency of the exchange. As mentioned above, exchanges also are responsible for setting trading procedures, hours of trading, contract characteristics, margin requirements, and so on for contracts traded on the individual exchanges.

7 SWAPS

A **swap** is an agreement between two parties (called counterparties) to exchange specified periodic cash flows in the future based on some underlying instrument or price (e.g., a fixed or floating rate on a bond or note). Like forward, futures, and option contracts, swaps allow firms to better manage their interest rate, foreign exchange, and credit risks. Swaps were introduced in the early 1980s, and the market for swaps has grown enormously in recent years. Figure 10–9 shows the growth in the notional value of swaps outstanding from 1987 through 2004. Of the $164.49 trillion outstanding in 2004, the notional value of swap contracts outstanding by U.S. commercial banks (by far the major participant in the swap markets) was $52.91 trillion in September 2004. The five generic types of swaps are interest rate swaps, currency swaps, credit risk swaps, commodity swaps, and equity swaps.[15] The asset or instrument underlying the swap may change, but the basic principle of a swap agreement is the same in that it involves the transacting parties restructuring their asset or liability cash flows in a preferred direction. In this section, we consider the role of the two major generic types of swaps—interest rate and currency. We look at other types of swaps and describe the ability of swaps to hedge various kinds of risk in more detail in Chapter 23.

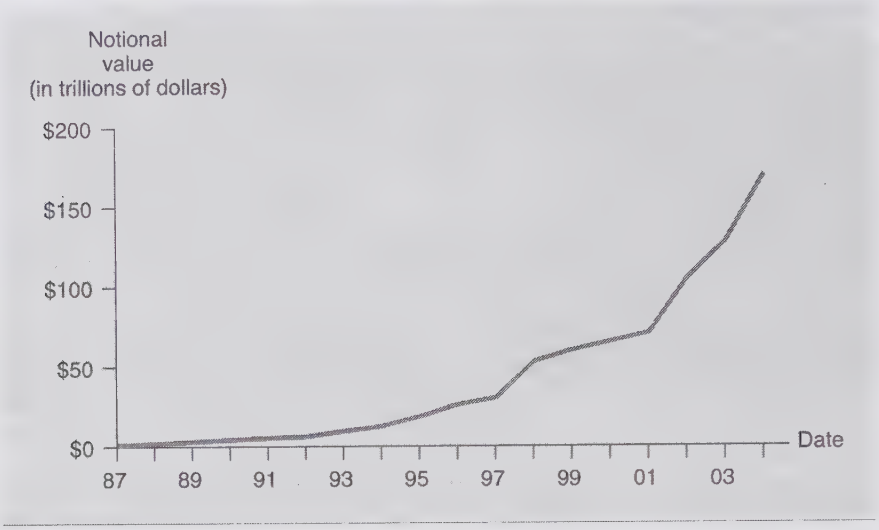
swap

An agreement between two parties to exchange assets or a series of cash flows for a specific period of time at a specified interval.

14. Contracts with other maturities also trade but are not reported in *The Wall Street Journal.*

15. There are also *swaptions,* which are options to enter into a swap agreement at some preagreed contract terms (e.g., a fixed rate of 10 percent) at some time in the future in return for the payment of an up-front premium.

FIGURE 10–9 Notional Value of Swaps Outstanding



Interest Rate Swaps

interest rate swap
An exchange of fixed-interest payments for floating-interest payments by two counterparties.

swap buyer
By convention, a party that makes the fixed-rate payments in an interest rate swap transaction.

notional principal
The principal amount involved in a swap.

swap seller
By convention, a party that makes the floating-rate payments in an interest rate swap transaction.

By far the largest segment of the swap market comprises **interest rate swaps.** Conceptually, an interest rate swap is a succession of forward contracts on interest rates arranged by two parties.[16] As such, it allows the swap parties to put in place long-term protection (sometimes for as long as 15 years) against interest rate risk (see Chapter 22). The swap reduces the need to "roll over" contracts from old ones into new ones if futures or forward contracts had been relied on to achieve such long-term hedging protection.[17]

In a swap contract, the **swap buyer** agrees to make a number of fixed interest rate payments based on a principal contractual amount (called the **notional principal**) on periodic settlement dates to the **swap seller.** The swap seller, in turn, agrees to make floating-rate payments, tied to some interest rate, to the swap buyer on the same periodic settlement dates. In undertaking this transaction, the party that is the fixed-rate payer is seeking to transform the variable-rate nature of its liabilities into fixed-rate liabilities to better match the fixed returns earned on its assets. Meanwhile, the party that is the variable-rate payer seeks to turn its fixed-rate liabilities into variable-rate liabilities to better match the variable returns on its assets.

EXAMPLE 10–3 Hedging Interest Rate Risk with an Interest Rate Swap

To explain the role of a swap transaction in protecting a firm against interest rate risk, we use a simple example of an interest rate swap. Consider two financial institutions. The first is a money center bank that has raised $50 million of its funds by issuing five-year, medium-term notes with 7 percent annual fixed coupons (see Table 10–9). On the asset side of its portfolio, the bank makes commercial and industrial (C&I) loans whose rates are indexed to annual changes in the London Interbank Offered Rate (LIBOR). Banks index

16. For example, a four-year swap with annual swap dates involves four net cash flows between the parties to a swap. This is essentially similar to arranging four forward rate agreement (FRA) contracts: a one-year, a two-year, a three-year, and a four-year contract.

17. For example, futures contracts are offered usually with a maximum maturity of two years or less.

TABLE 10–9 Money Center Bank Balance Sheet

Assets		Liabilities	
C & I loans (rate indexed to LIBOR)	$50 million	Medium-term notes (coupons) fixed at 7% annually	$50 million

most large commercial and industrial loans to either LIBOR or the federal funds rate in the money market.

As a result of having floating-rate loans and fixed-rate liabilities in its asset–liability structure, the money center bank is exposed to interest rate risk. Specifically, if interest rates decrease, the bank's interest income decreases, since the variable interest return on loans (assets) will fall relative to the fixed cost of its funds (liabilities).

One way for the bank to hedge the risk of this exposure is to alter the interest rate sensitivity of its liabilities by transforming them into floating-rate liabilities that better match the (floating) rate sensitivity of its asset portfolio. The bank can make changes either on or off the balance sheet. On the balance sheet, the bank could attract an additional $50 million in short-term deposits that are indexed to the LIBOR rate in a manner similar to its loans. The proceeds of these deposits can be used to pay off its medium-term notes. This reduces the difference in the interest rate sensitivity between the bank's assets and liabilities. Alternatively, the bank could go off the balance sheet and sell an interest rate swap—that is, enter into a swap agreement to make the floating-rate payment side of a swap agreement.

The second party to the swap in this example is a thrift institution (a savings bank) that has invested $50 million in fixed interest rate residential mortgage assets of long maturity. To finance this residential mortgage portfolio, the savings bank has had to rely on short-term certificates of deposit with an average duration of one year (see Table 10–10). On maturity, these CDs must be "rolled over" at the current market rate.

Consequently, the savings bank's asset–liability balance sheet structure is the reverse of the money center bank's—if interest rates increase, the bank's interest expense increases. Since its assets (mortgages) are fixed rate, while its liabilities (deposits) are floating, the bank's net income falls.

The savings bank could hedge this interest rate risk exposure by transforming the short-term floating-rate nature of its liabilities into fixed-rate liabilities that better match the long-term maturity structure of its assets by either on- or off-balance-sheet hedging. On the balance sheet, the thrift could issue long-term notes (or bonds) with a maturity equal (or close to equal) that on the mortgages. The proceeds of the sale of the notes can be used to pay off the CDs. As a result, it would be funding long-term mortgages with long-term notes. Alternatively, the thrift could go off the balance sheet and buy a swap—that is, the thrift could enter into a swap agreement to make the fixed-rate payment side of a swap agreement.

The opposing balance sheet and interest rate risk exposures of the money center bank and the savings bank provide the necessary conditions for an interest rate swap agreement between the two parties. This swap agreement can be arranged directly by the two parties themselves—for example, by direct telephone contact. However, it is likely that a third financial institution—another commercial bank or an investment bank—would act either as a broker or an agent, receiving a fee[18] for bringing the two parties together or intermediating fully by accepting the credit risk exposure and guaranteeing the cash flows underlying the swap contract. We illustrate these swap transactions in Figure 10–10. By acting as a principal as well as an agent in arranging the swap, the third party financial institution can add a credit risk premium to the fee. However, the credit risk exposure of a swap to a financial institution is somewhat less than

18. One way the fees are reflected is in swap bid-ask spreads. For example, a bank can either make fixed-rate payments (buy a swap) or receive fixed-rate payments (sell a swap). Generally, the fixed rate for selling a swap is set at a margin above the fixed rate for buying.

TABLE 10–10 Savings Bank Balance Sheet

Assets		Liabilities	
Fixed-rate mortgages	$50 million	Short-term CDs (one year)	$50 million

FIGURE 10–10 A Swap Transaction

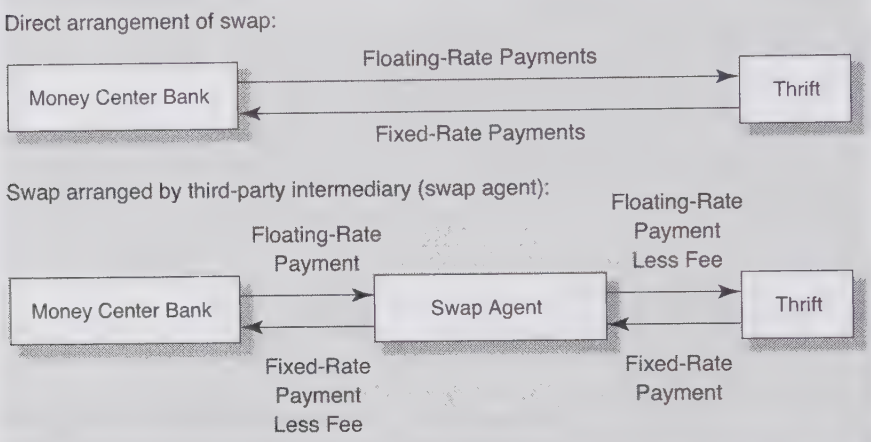
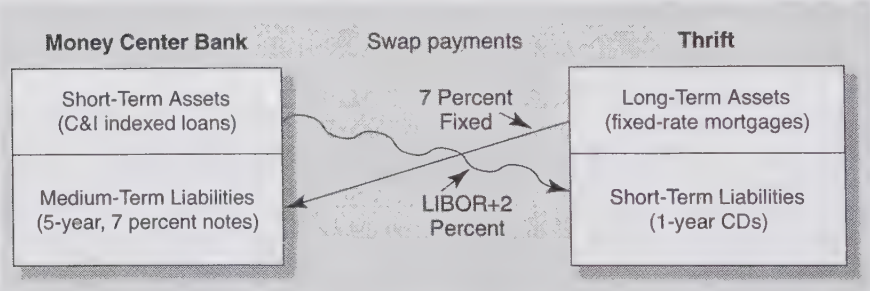


FIGURE 10–11 Fixed-Floating Rate Swap



that on a loan (see Chapter 23). Conceptually, when a third-party financial institution fully intermediates the swap, that institution is really entering into two separate swap agreements—in this example, one with the money center bank and one with the savings bank.

The swap agreement that is arranged might dictate that the thrift send fixed payments of 7 percent per annum of the notional $50 million value of the swap to the money center bank, each year for five years, to allow the money center bank to cover fully the coupon interest payments on its note issue. In return, the money center bank sends annual payments indexed to the one-year LIBOR, for five years, to help the thrift better cover the cost of refinancing its one-year renewable CDs. Suppose that the money center bank agrees to send the thrift annual payments at the end of each year equal to the one-year LIBOR plus 2 percent.[19] We depict this fixed-floating rate swap transaction in Figure 10–11.

As a result of the swap, the money center bank has transformed its five-year, fixed-rate liability notes into a variable-rate liability matching the variability of returns on its C&I

19. These rates implicitly assume that this is the cheapest way each party can hedge its interest rate exposure. For example, LIBOR plus 2 percent is the lowest cost way that the money center bank can transform its fixed-rate liabilities into floating-rate liabilities.

loans. Further, through the interest rate swap, the money center bank effectively pays LIBOR plus 2 percent for its financing. The thrift has also transformed its variable-rate CDs into fixed-rate payments similar to those received on its fixed-rate mortgages.

Currency Swaps

currency swap
A swap used to hedge against exchange rate risk from mismatched currencies on assets and liabilities.

Interest rate swaps are long-term contracts that can be used to hedge interest rate risk exposure. This section considers a simple example of how **currency swaps** can be used to immunize or hedge against exchange rate risk when firms mismatch the currencies of their assets and liabilities.

Fixed-Fixed Currency Swaps. Consider a U.S. financial institution with all of its fixed-rate assets denominated in dollars. It is financing part of its asset portfolio with a £100 million issue of five-year, medium-term British pound sterling notes that have a fixed annual coupon of 6 percent. By comparison, a financial institution in the United Kingdom has all its assets denominated in pounds; it is partly funding those assets with a $200 million issue of five-year, medium-term dollar notes with a fixed annual coupon of 6 percent.

These two financial institutions are exposed to opposing currency risks. The U.S. institution is exposed to the risk that the dollar will depreciate (decline in value) against the pound over the next five years, which would make it more costly to cover the annual coupon interest payments and the principal repayment on its pound-denominated note liabilities. On the other hand, the U.K. institution is exposed to the risk that the dollar will appreciate against the pound, making it more difficult to cover the dollar coupon and principal payments on its five-year, $200 million note liabilities.

These financial institutions can hedge their exposures either on or off the balance sheet. Assume that the dollar/pound exchange rate is fixed at $2/£1. On the balance sheet, the U.S. financial institution can issue $200 million in five-year, medium-term dollar notes. The proceeds of the sale can be used to pay off the £100 million of five-year, medium-term pound notes. Similarly, the U.K. financial institution can issue £100 million in five-year, medium-term pound notes, using the proceeds to pay off the $200 million of five-year, medium-term dollar notes. Both institutions have taken actions on the balance sheet so that they are no longer exposed to movements in the exchange rate between the two currencies (i.e., their assets and liabilities are currency matched).

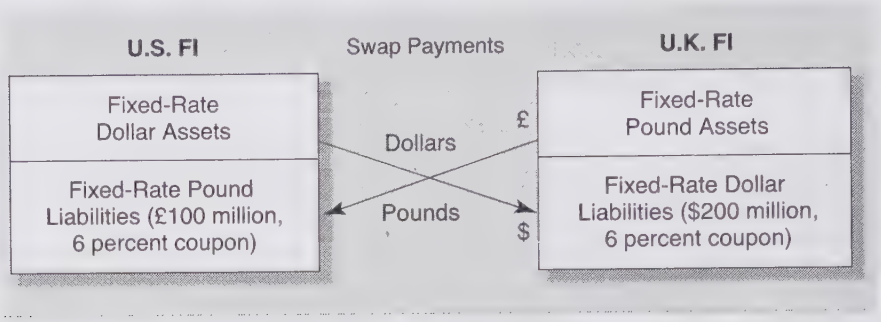
EXAMPLE 10–4 Expected Cash Flows on Fixed-Fixed Currency Swap

Alternatively, the U.K. and U.S. financial institutions can enter into a currency swap by which the U.K. institution sends annual payments in pounds to cover the coupon and principal repayments of the U.S. financial institution's pound sterling note issue, and the U.S. financial institution sends annual dollar payments to the U.K. financial institution to cover the interest and principal payments on its dollar note issue.[20] We summarize this currency swap in Figure 10–12. As a result of the swap, the U.K. financial institution transforms its fixed-rate dollar liabilities into fixed-rate pound liabilities that better match the fixed-rate pound cash flows from its asset portfolio. Similarly, the U.S. financial institution transforms fixed-rate pound liabilities into fixed-rate dollar liabilities that better match the fixed-rate dollar cash flows on its asset portfolio. In undertaking this exchange of cash flows, the two parties normally agree on a fixed exchange rate for the cash flows at the beginning of the period.[21] In this example, the fixed exchange rate is $2/£1.

20. In a currency swap, both principal and interest payments are usually included as part of the swap agreement. For interest rate swaps, it is usual to include only interest rate payments. The reason for this is that both principal and interest are exposed to foreign exchange risk.

21. As with interest rate swaps, this exchange rate reflects the contracting parties' expectations as to future exchange rate movements.

FIGURE 10–12 Fixed-Fixed Pound/Dollar Currency Swap



Note in the example above that should the exchange rate change from the rate agreed in the swap ($2/£1), either one or the other side would be losing in the sense that a new swap might be entered into at a more favorable exchange rate to one party. Specifically, if the dollar were to appreciate against the pound over the life of the swap, the agreement would become more costly for the U.S. financial institution. If, however, the dollar depreciated, the U.K. financial institution would find the agreement increasingly costly over the swap's life.

Swap Markets

Swap transactions are generally heterogeneous in terms of maturities, indexes used to determine payments, and timing of payments—there is no standardized contract. Swap dealers exist to serve the function of taking the opposite side of each transaction in order to keep the swap market liquid by locating or matching counterparties or, in many cases, taking one side of the swap themselves. In a direct swap between two counterparties, each party must find another party having a mirror image financing requirement—for example, a financial institution in need of swapping fixed-rate payments, made quarterly for the next 10 years, on $25 million in liabilities must find a counterparty in need of swapping $25 million in floating-rate payments made quarterly for the next 10 years. Without swap dealers, the search costs of finding such counterparties to a swap can be significant.

A further advantage of swap dealers is that they generally guarantee swap payments over the life of the contract. If one of the counterparties defaults on a direct swap, the other counterparty is no longer adequately hedged against risk and may have to replace the defaulted swap with a new swap at less favorable terms (replacement risk). By booking a swap with a swap dealer, a default by a counterparty will not affect the other counterparty. The swap dealer incurs any costs associated with the default (the fee or spread charged by the swap dealer to each party in a swap incorporates this default risk).[22] Commercial and investment banks have evolved as the major swap dealers, mainly because of their close ties to the financial markets and their specialized skills in assessing credit risk. Each swap market dealer manages a large "book" of swaps listing its swap positions. As a result, swap dealers can also diversify some of their risk exposure away.

In contrast to futures and options markets, swap markets are governed by very little regulation—there is no central governing body overseeing swap market operations. However, the International Swaps and Derivatives Association (ISDA) is a global trade association with over 600 member institutions (including most of the world's major financial institutions) from some 47 countries that sets codes and standards for swap markets. Established in 1985, the ISDA establishes, reviews, and updates the code of standards (the language and provisions) for swap documentation. The ISDA also acts as the spokesgroup for the industry on regulatory changes and issues, promotes the development of risk management practices for swap dealers (for example, the ISDA was instrumental in helping to develop the guidelines

www.isda.org

www.federalreserve.gov

www.fdic.gov

22. For interest rate swaps where the dealer intermediates, a different (higher) fixed rate will be set for receiving fixed rate payments compared to paying fixed rate.

set by the Basle committee on capital adequacy in financial institutions—see Chapter 13), provides a forum for informing and educating swap market participants about relevant issues, and sets standards of commercial conduct for its members.

Further, because commercial banks are the major swap dealers, the swap markets are subject, indirectly, to regulations imposed by the Board of Governors of the Federal Reserve, the FDIC, and other bank regulatory agencies charged with monitoring bank risk. For example, commercial banks must include swap risk exposure when calculating risk-based capital requirements (see Chapter 13). To the extent that swap activity is part of a bank's overall business, swap markets are monitored for abuses. Investment banks and insurance companies have recently become bigger players in the swap markets, however, and these dealers are subject to few regulations on their swap dealings.

DO YOU UNDERSTAND?

1. What is a swap?

CAPS, FLOORS, AND COLLARS

8

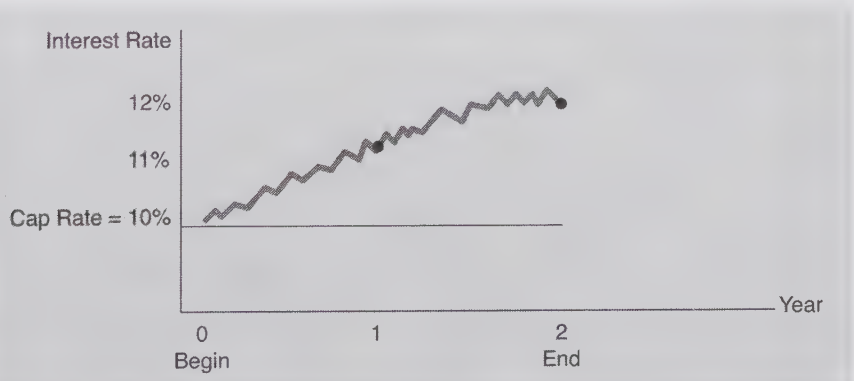
Caps, floors, and collars are derivative securities that have many uses, especially in helping an FI to hedge interest rate risk. In general, FIs purchase interest rate caps if they are exposed to losses when interest rates rise. Usually, this happens if FIs are funding assets with floating-rate liabilities such as notes indexed to the London Interbank Offered Rate (or some other floating cost of funds) and they have fixed-rate assets or they are net long in bonds. By contrast, FIs purchase floors when they have fixed costs of debt and have variable or floating rates (returns) on assets or they are net short in bonds. Finally, FIs purchase collars to finance cap or floor positions or are concerned about excessive interest rate volatility.

cap

A call option on interest rates, often with multiple exercise dates.

Buying a **cap** means buying a call option or a succession of call options on interest rates.[23] Specifically, if interest rates rise above a cap rate, which acts in a similar fashion to a strike price in an option contract, the seller of the cap—usually a bank—compensates the buyer—for example, another financial institution—in return for an up-front premium. Suppose that two firms enter a two-year cap agreement with a notional value of $1 million. The cap rate is 10 percent and payments are settled once a year based on year-end interest rates. For the interest rate movements shown in Figure 10–13, the cap writer owes the cap buyer (11% − 10%) × $1 million, or $10,000, at the end of year 1, and (12% − 10%) × $1 million, or $20,000, at the end of year 2. As a result, buying an interest rate cap is like

FIGURE 10–13 Hypothetical Path of Interest Rates during a Cap Agreement



23. Note that a cap can be viewed as a call option on interest rates (as discussed here) or as a put option on bond prices, since rising interest rates mean falling bond prices. Similarly, a floor (discussed in the next paragraph) can be viewed as a put option on interest rates or a call option on bond prices. We follow market convention and discuss caps and floors as options on interest rates rather than on bond prices.

buying insurance against an (excessive) increase in interest rates. A cap agreement can have one or many exercise dates.

floor
A put option on interest rates, often with multiple exercise dates.

Buying a **floor** is similar to buying a put option on interest rates. If interest rates fall below the floor rate, the seller of the floor compensates the buyer in return for an up-front premium. For example, suppose that two financial institutions enter a two-year floor agreement with a notional value of $1 million. The floor rate is 8 percent, and payments are settled once a year based on year-end rates. For the interest rate movements shown in Figure 10–14, the floor writer owes the floor buyer (8% − 7%) × $1 million, or $10,000, at the end of year 1, and (8% − 6%) × $1 million, or $20,000, at the end of year 2. As with caps, floor agreements can have one or many exercise dates.

collar
A position taken simultaneously in a cap and a floor.

A **collar** occurs when a firm takes a simultaneous position in a cap and a floor, usually *buying* a cap and *selling* a floor. The idea here is that the firm wants to hedge itself against rising rates but wants to finance the cost of the cap. One way to do this is to sell a floor and use the premiums earned on the floor to pay the premium on the purchased cap. For example, suppose that a financial institution enters into a two-year collar agreement with a notional value of $1 million. The floor rate is 8 percent and the cap rate is 10 percent. Payments are settled once a year based on year-end rates. For the interest rate movements shown in Figure 10–15, the collar buyer, the financial institution, gains (11% − 10%) × $1 million, or $10,000, at the end

FIGURE 10–14 Hypothetical Path of Interest Rates during a Floor Agreement

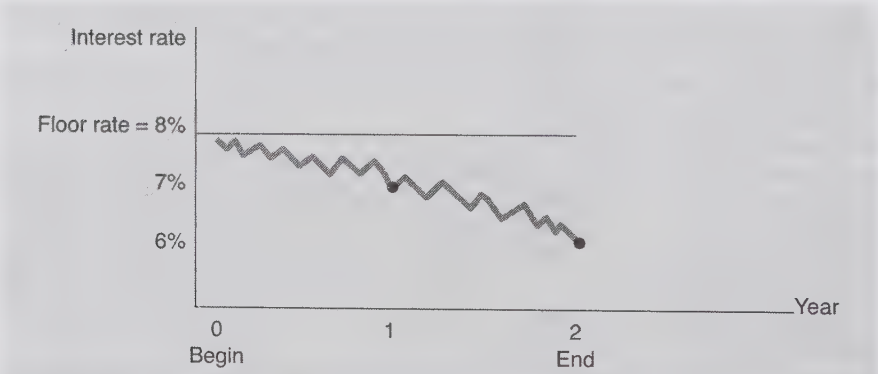
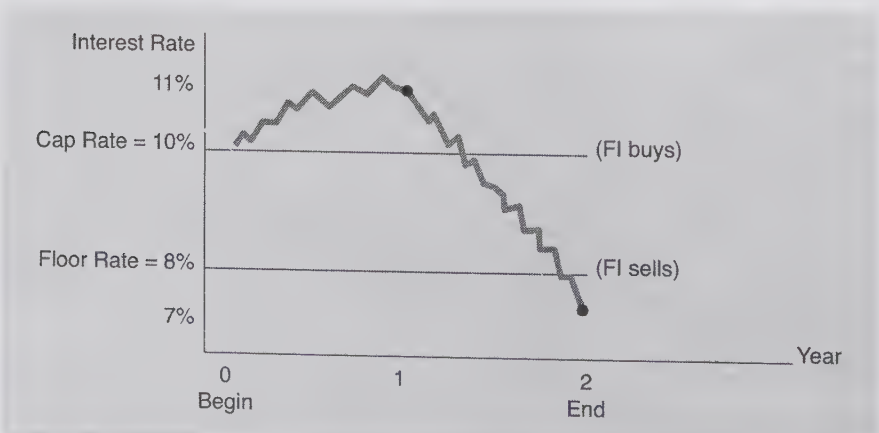


FIGURE 10–15 Hypothetical Path of Interest Rates during a Collar Agreement



DO YOU UNDERSTAND?

of year 1. However, since the financial institution has written or sold a floor to another financial institution to finance the cap purchase, it pays (8% − 7%) × $1 million, or $10,000, at the end of year 2.

Many firms invested in caps and collars in the mid-2000s in expectation that interest rates would increase. For example, in 2004 Deutsche Bank arranged a $900 million collar for Aluminum Bahrain, which wanted to hedge a large portfolio against interest rate increases with minimal costs.

9 INTERNATIONAL ASPECTS OF DERIVATIVE SECURITIES MARKETS

Tables 10–11 and 10–12 report the amount of global over-the-counter (OTC) and exchange-traded derivative securities from 1999 through 2004. Notice global OTC trading far outweighs exchange trading. The total notional amount of outstanding OTC contracts was $220.06 trillion in 2004 compared to exchange-traded contracts which totaled $48.99 trillion in 2004. In both markets interest rate contracts dominated: $164.63 trillion in notional value in the OTC markets and $45.36 trillion on exchanges.

U.S. markets and currencies continue to dominate global derivative securities markets. On organized exchanges, North American markets traded $27.90 trillion of the $48.99 trillion contracts outstanding in 2004. In the OTC markets, $24.55 trillion of the currency contracts,

TABLE 10–11 Amounts of Global Derivative Securities Outstanding on the OTC Market

(in billions of dollars)

Contract	1999	2001	2004
Total Contracts	$88,202	$111,115	$220,058
Foreign Exchange Contracts:	14,344	16,748	26,997
By currency:			
Canadian dollar	647	593	968
Euro	4,667	6,368	10,312
Japanese yen	4,236	4,178	6,516
Pound sterling	2,242	2,315	4.614
Swiss franc	880	800	1,344
U.S. dollar	12,834	15,410	24,551
Other	2,746	3,689	5.687
Interest Rate Contracts:	60,091	77,513	164,626
By currency:			
Canadian dollar	825	781	1,298
Euro	20,692	26,185	63,006
Japanese yen	12,391	11,799	21,103
Pound sterling	4,588	6,215	11,867
Swiss franc	1,414	1,362	2,651
U.S. dollar	16,510	27,422	57,827
Other	3,195	3,673	6,872
Equity-Linked Contracts:	1,809	1,881	4,520
By currency:			
U.S. equities	516	376	867
European equities	1,040	1,353	2,768
Japanese equities	124	56	447
Other equities	129	97	438

Source: Bank for International Settlements, Quarterly Review, June 2002 and December 2004. **www.bis.org**

TABLE 10–12 Derivative Financial Instruments Trade on Organized Exchanges
(in billions of dollars)

Contract	1999	2001	2004
Futures:			
All markets:	$8,294.2	$9,633.5	$17,661.8
Interest rate	7,913.9	9,234.0	17,024.8
Currency	36.7	65.6	84.1
Equity index	343.5	334.0	552.9
North America:	3,553.2	5,906.4	9,777.9
Europe:	2,379.2	2,444.5	5,533.8
Asia and Pacific:	2,149.8	1,202.0	2,200.7
Other markets:	211.9	80.4	149.4
Options:			
All markets:	5,258.7	14,083.7	31,330.3
Interest rate	3,755.5	12,492.6	28,335.0
Currency	22.4	27.4	37.2
Equity index	1,480.8	1,563.7	2.958.1
North America:	3,377.1	10,292.2	18,119.7
Europe:	1,603.2	3,698.0	12,975.4
Asia and Pacific:	240.7	62.8	169.6
Other markets:	37.7	30.8	65.6

Source: Bank for International Settlements, Quarterly Review, June 2002 and December 2004. **www.bis.org**

DO YOU UNDERSTAND?

$57.83 trillion of the interest rate contracts, and $0.9 trillion of the equity-linked contracts were denominated in U.S. dollars.

The euro and European derivative securities markets, however, are now a strong second behind the United States. In 2004 European exchange markets traded $18.51 trillion of the total $48.99 trillion contracts. In the OTC markets, $10.3 trillion of the currency contracts $63.01 trillion of the interest rate contracts, and $2.77 trillion of the equity-linked contracts were denominated in the euro or European currencies. In fact, in 1999 and 2004, more interest rate contracts on the OTC were euro-denominated than U.S. dollar-denominated.

As has been seen in earlier chapters on other financial markets, the continued economic and financial problems in Japan have resulted in a drop in the value of derivative securities traded on Japanese exchanges and denominated in the Japanese yen. Overall, Asian and Pacific derivative security exchanges have seen a drop in amounts outstanding, falling to $2.37 trillion in 2004. In the OTC derivatives security markets $6.52 trillion of the currency contracts, $21.10 trillion of interest rate contracts, and $0.45 trillion of the equity-linked contracts were denominated in the yen in 2004.

SUMMARY

In this chapter, we introduced the major derivative securities and the markets in which they trade. Derivative securities (forwards, futures, options, and swaps) are securities whose value depends on the value of an underlying asset but whose payoff is not guaranteed with cash flows from these assets. Derivative securities can be used as investments on which a trader hopes to directly profit or as hedge instruments used to protect the trader against risk from another asset or liability held. We examined the characteristics of the various securities and the markets in which each trade. We look at how these securities are used by financial institutions to hedge various risks in Chapter 23.

SEARCH THE SITE

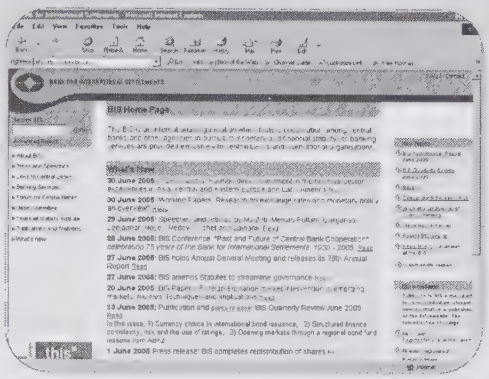
Go to the Bank for International Settlements Web site at **www.bis.org** and find the most recent data on the amount of derivatives traded worldwide over the counter and on organized exchanges using the following steps.

Click on "BIS Quarterly Review"

Click on "Statistical Annex Read"

Click on "Derivatives Markets"

This downloads a file onto your computer that contains the relevant data.



Questions

1. By what percentage have these values changed since 2004 as reported in Tables 10–11 and 10–12?
2. What countries are currently the biggest traders of derivative securities?

QUESTIONS

1. What is a derivative security?
2. What is the difference between a spot contract, a forward contract, and a futures contract?
3. What are the functions of floor brokers and professional traders on the futures exchanges?
4. What is the purpose of requiring a margin on a futures or option transaction? What is the difference between an initial margin and a maintenance margin?
5. When is a futures or option trader in a long versus a short position in the derivative contract?
6. What is the meaning of a Treasury bond futures price quote of 103–13?
7. Refer to Table 10–5.
   a. What was the settlement price on the December 2006 Eurodollar futures contract on Monday, January 10, 2005?
   b. How many 30-day federal funds futures contracts traded on Friday, January 7, 2005?
   c. What is the face value on a Swiss franc currency futures contract on January 10, 2005?
   d. What was the settlement price on the March 2005 DJIA futures contract on January 7, 2005?
8. Refer to Table 10–5.
   a. If you think two-year Treasury note prices will fall between January 10, 2005, and June 2005, what type of futures position would you take?
   b. If you think inflation in Japan will increase by more than that in the United States between January and March 2005, what type of futures position would you take?
   c. If you think stock prices will fall between January and June 2005, what type of position would you take in the June S&P 500 Index futures contract? What happens if stock prices actually rise?
9. Suppose you purchase a Treasury bond futures contract at a price of 95 percent of the face value, $100,000.
   a. What is your obligation when you purchase this futures contract?
   b. Assume that the Treasury bond futures price falls to 94 percent. What is your loss or gain?
   c. Assume that the Treasury bond futures price rises to 97. What is your loss or gain?
10. **eXcel Using a Spreadsheet to Calculate Profit and Loss on Futures Transactions:** At the beginning of the quarter, you purchased a $100,000 Treasury bond futures contract for 108–12. Calculate the profit on the futures contract if the price at the end of the quarter is 106–16, 108–20, 110–8, and 112–02.

Price at Beginning of Quarter	Price at End of Quarter	=>	The Profit or Loss Is
$100,000 × 108.375 = 108,375	$100,000 × 106.5 = 106,500		−$1,875
100,000 × 108.375 = 108,375	100,000 × 108.625 = 108,625		$250
100,000 × 108.375 = 108,375	100,000 × 110.25 = 110.250		1,875
100,000 × 108.375 = 108,375	100,000 × 112.0625 = 112,062.5		3,687.5

11. What is an option? How does an option differ from a forward or futures contract?
12. What is the difference between a call option and a put option?
13. What must happen to the price of the underlying T-bond futures contract for the purchaser of a call option on T-bond futures to make money? How does the writer of the call option make money?

14. What must happen to the price of the underlying stock for the purchaser of a put option on the stock to make money? How does the writer of the put option make money?
15. You have taken a long position in a call option on IBM common stock. The option has an exercise price of $136 and IBM's stock currently trades at $140. The option premium is $5 per contract.
    a. What is your net profit on the option if IBM's stock price increases to $150 at expiration of the option and you exercise the option?
    b. What is your net profit if IBM's stock price decreases to $130?
16. You have purchased a put option on Pfizer common stock. The option has an exercise price of $38 and Pfizer's stock currently trades at $40. The option premium is $0.50 per contract.
    a. What is your net profit on the option if Pfizer's stock price does not change over the life of the option?
    b. What is your net profit on the option if Pfizer's stock price falls to $34 and you exercise the option?
17. What are the three ways an option holder can liquidate his or her position?
18. Refer to Table 10–8.
    a. How many American Airlines January 7.50 put options were outstanding at the open of trading on Monday, January 10, 2005?
    b. What was the closing price of a T-note March 109 futures call option on January 10, 2005?
    c. How many call options on the S&P 500 Stock Index futures contract traded on Friday, January 7, 2005?
    d. What was the open interest on March 2005 put options (with an exercise price of 92) on the DJ Industrial Average stock index on January 10, 2005?
19. What factors affect the value of an option?
20. Who are the major regulators of futures and options markets?
21. What is a swap?
22. What is the difference between an interest rate swap and a currency swap?
23. Which party is the swap buyer and which is the swap seller in a swap transaction?
24. A commercial bank has fixed-rate long-term loans in its asset portfolio and variable-rate CDs in its liability portfolio. Bank managers believe interest rates will increase in the future. What side of a fixed-floating rate swap would the commercial bank need to take to protect against this interest rate risk?
25. An insurance company owns $50 million of floating-rate bonds yielding LIBOR plus 1 percent. These loans are financed with $50 million of fixed-rate guaranteed investment contracts (GICs) costing 10 percent. A finance company has $50 million of auto loans with a fixed rate of 14 percent. The loans are financed with $50 million in CDs at a variable rate of LIBOR plus 4 percent.
    a. What is the risk exposure of the insurance company?
    b. What is the risk exposure of the finance company?
    c. What would be the cash flow goals of each company if they were to enter into a swap agreement?
    d. Which company would be the buyer and which company would be the seller in the swap?
    e. Diagram the direction of the relevant cash flows for the swap arrangement.
26. A commercial bank has $200 million of floating-rate loans yielding the T-bill rate plus 2 percent. These loans are financed with $200 million of fixed-rate deposits costing 9 percent. A savings bank has $200 million of mortgages with a fixed rate of 13 percent. They are financed with $200 million in CDs with a variable rate of T-bill rate plus 3 percent.
    a. Discuss the type of interest rate risk each institution faces.
    b. Propose a swap that would result in each institution having the same type of asset and liability cash flows.
    c. Show that this swap would be acceptable to both parties.
27. An American firm has British pound-denominated accounts payable on its balance sheet. Managers believe the exchange rate of British pounds to U.S. dollars will depreciate before the accounts will be paid. What type of currency swap should the firm enter?
28. What is the difference between a cap, a floor, and a collar? When would a firm enter any of these derivative security positions?

APPENDIX 10A: Black–Scholes Option Pricing Model

View this appendix at
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